**OPERATIONAL REQUIREMENTS DOCUMENT (ORD)**
**For**
**Intelligence Modeling and Simulation for Evaluation (IMASE)**

## CONTENTS

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## PREFACE

**1.** Currently, there is no existing Department of Defense modeling and simulation (M&S) system, system-of-systems, M&S federation, or singular instrumentation capability that satisfies the intelligence electronic warfare (IEW) testing requirements at the requisite level of fidelity, consistency, interoperability, and Battlefield Operating System (BOS) stimulation. A robust and seamlessly integrated M&S and instrumentation (M&S&I) (figure P-1) capability, represented by state-of-the-art hardware and software, is needed to satisfy the numerous current and emerging test requirements.

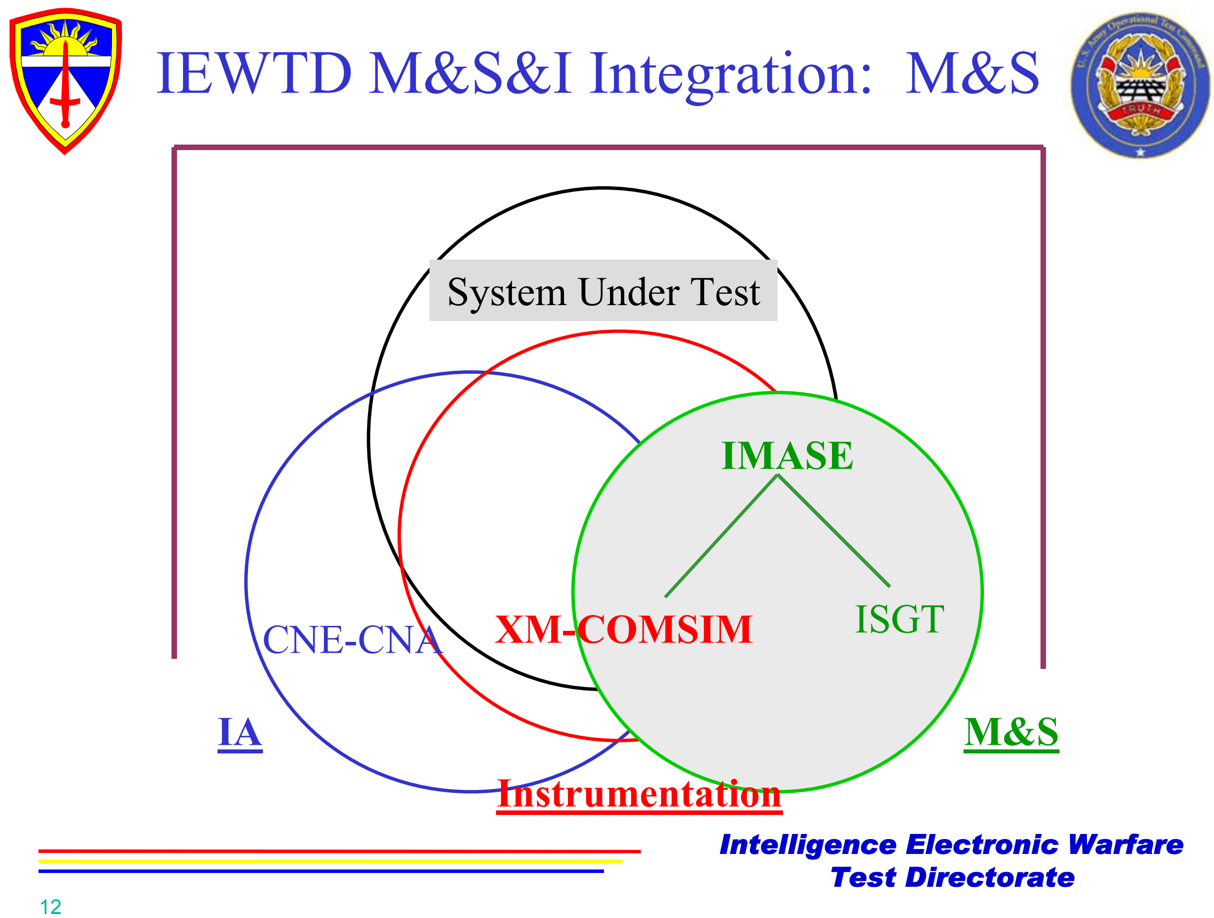


**Figure P-1. M&S&I Integration.**

**a.** The M&S&I structure required to support major portions of all IEW testing events (for example, Test Schedule and Review Committee (TSARC) as well as customer tests) is concentrated within four foundational pillars representing specific M&S&I capabilities (figure P-2): scenario generation, product development, product delivery, and system under test (SUT) performance scoring.

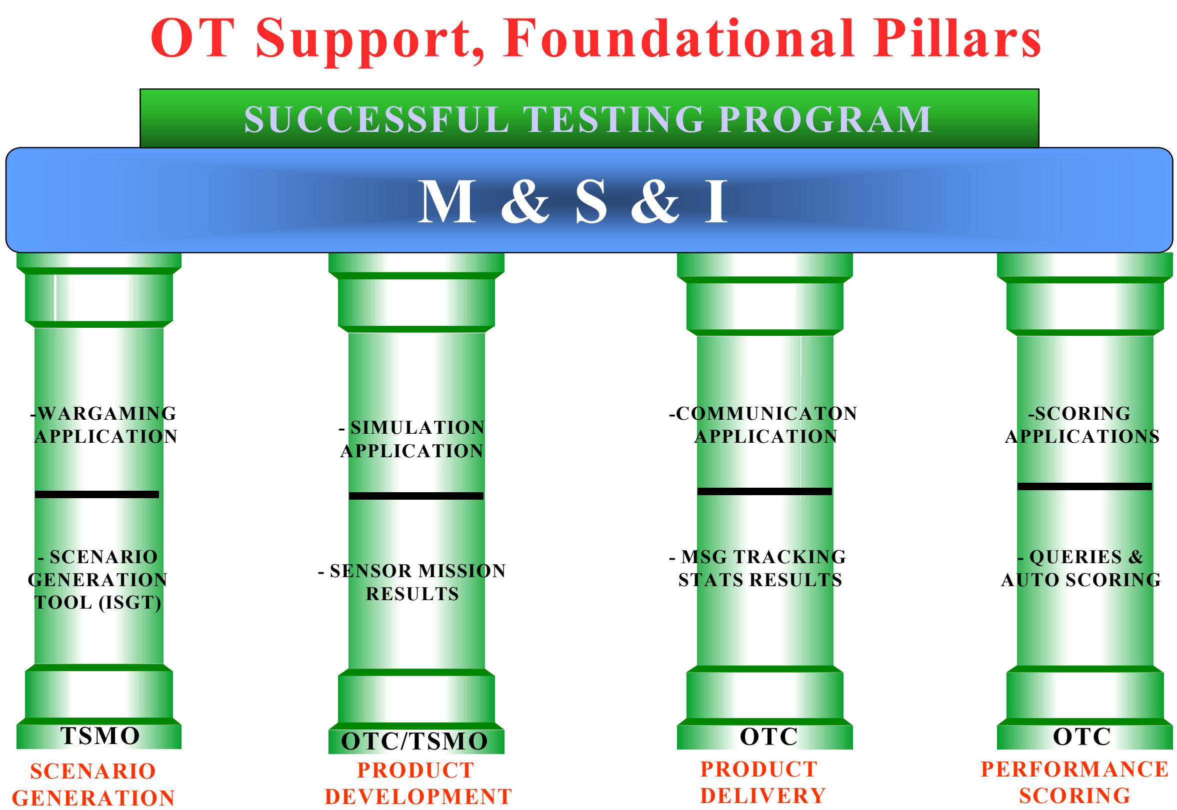


**Figure P-2. M&S&I Foundational Support Pillars.**

**(1)** The first pillar, scenario generation, has two primary definitions. Definition one is the depiction of large numbers of threat forces at the object level (trucks, trailers, and tanks). Each entity must have its representative attribute or intelligence detectables for each intelligence discipline. This depiction includes representative formations and deployments needed by intelligence analysts, along with appropriate schemes of maneuver, during a 96- to 120-hour scenario period. Definition two occurs once definition one has been completed. It is the orchestration of instrumentation vans (radio frequency (RF) over-the-air) and virtual signal injection to represent the doctrinal emanations from threat systems.

**(2)** The second pillar, product development, can include Voice Transmissions, United States Message Text Format (USMTF), Joint Variable Message Format (JVMF), United States Signals Intelligence Directive (USSID), and Defense Messaging System (DMS) formatted messages. It can also include graphics; overlays; Tactical Unmanned Aerial Vehicle (TUAV) video (electro-optics (EO)/infrared (IR); Common Ground Station (CGS) Moving Target Indicator (MTI) and Synthetic Aperture Radar (SAR); and real-time generation (interactivity) of RF and textual messages. These are all designed to meet SUT product-generation requirements in a timely manner and to represent IMASE threshold requirements. Communications Simulation (XM-COMSIM)/Target Receiver Injection Module (TRIM) Phase II (PII) interaction is an objective requirement.

**(3)** The third pillar, product delivery, is primarily the communications and stimulation portion of M&S. This product delivery can include local area network (LAN), wide area network (WAN), mobile subscriber equipment (MSE), and combat net radio (CNR). Additionally, M&S must be capable of connecting to other M&S systems using high-level architecture (HLA) or some other medium, such as protocol data units (PDUs) or distributive interactive simulation (DIS).

**(4)** The fourth pillar, SUT performance scoring, includes data harvesting, scoring, causality, validity, accuracy, timeliness, and completeness.

**b.** The Intelligence Modeling and Simulation for Evaluation (IMASE) system-of-systems will consist of computer-based battle simulation models that portray the operational environment. It is needed to support the overall Army-acquisition process and the events under the simulation based acquisition (SBA) and simulation for modeling acquisition requirements and training (SMART) concept and directives.

**(1)** The IMASE system-of-systems will primarily increase the effectiveness and thoroughness of intelligence system operational testing. It will support the acquisition process by simulating the fidelity, consistency, and robustness of actual systems within a synthetic environment. In conjunction with other simulations, IMASE will provide the intelligence portion of the value-added tactical operations center (TOC) environment using scenarios, which cover a large range of the live, constructive, and virtual environments.

**(2)** IMASE will provide simulation capability and support tools to create realistic operational conditions for operational testing and the development of stay-behind training support packages that underpin cradle-to-grave initiatives (for example, SBA) used within the system acquisition process. Additionally, IMASE may be suited to provide support beyond the research, development and acquisition (RDA) domain and into the training, exercises, and mission operations (TEMO) and advanced concepts and requirements (ACR) domain. The IMASE program objectives include supporting total army and joint force events from battalion through echelons above corps with scenarios from across the operational continuum. It will reduce the resources required to plan, execute, and report on SUT performance during test events executed in a simulation environment. IMASE will support real-time test events in all types of operational environments supporting all IEW BOSs.

**(3)** IMASE functional requirements for producing and sustaining a complete simulation environment encompass rapid scenario preparation, generation of supporting products (for example, messages, estimates, reports, overlays), stimulation of the SUT within a supported TOC environment, control of distributed test events, and integrated SUT scoring capability. The requirements for IMASE include the ability to interact with other HLA- and DIS-compliant systems, interact with other constructive simulations, as well as live, instrumented SUT and test support platforms. Thus, IMASE will provide the constructive simulation shell to surround virtual and live test participants (figure P-3). The functional requirements are based on concepts of using a multisensor, (sensor-to-shooter) systems-of-systems approach to operational test and evaluation (OT&E), integrating all appropriate Army Battle Command System (ABCS) structures and interfaces to prove the *value-added* of the SUT. IMASE will be able to support stand-alone OT&E events or participate through federation in an integrated and/or distributed test or training environment.

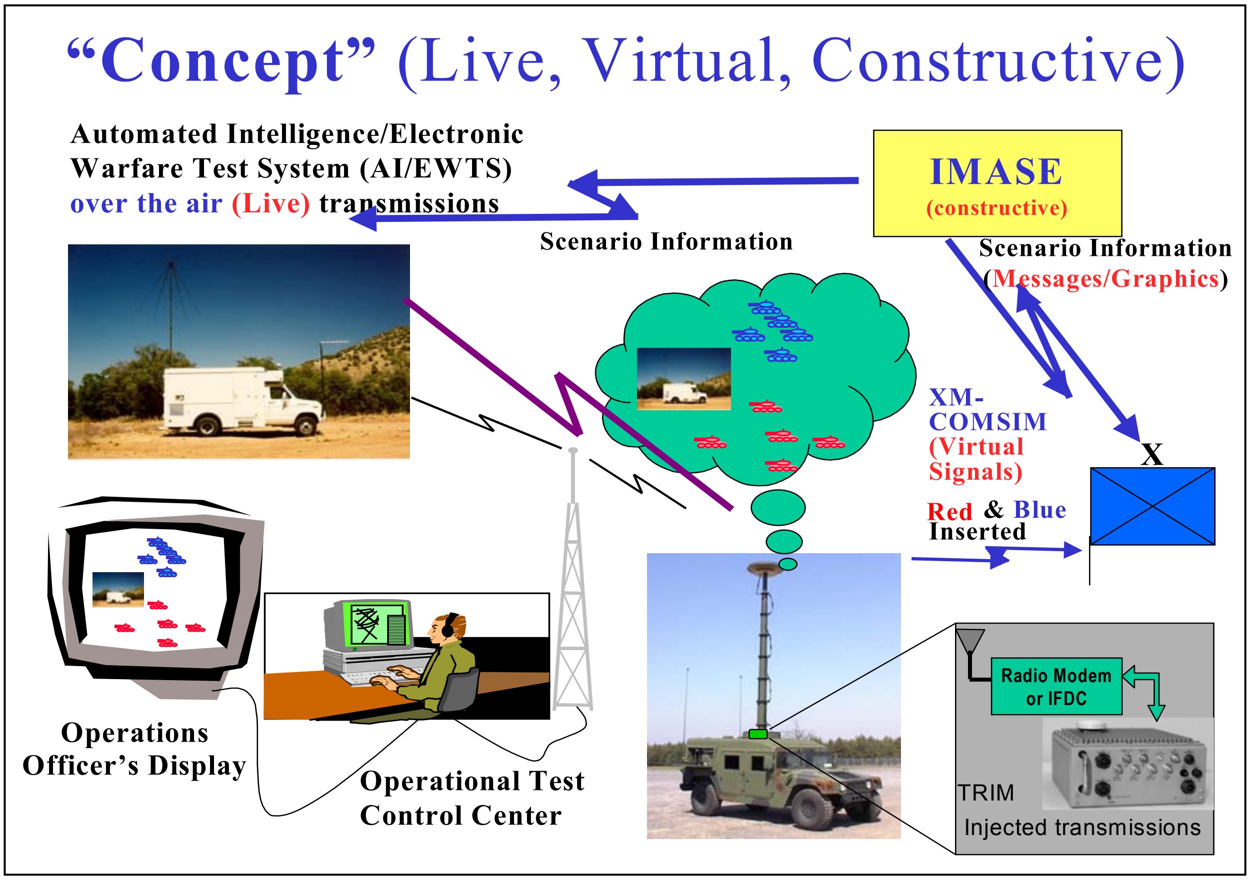


**Figure P-3. IMASE Operational Concept.**

**(4)** The IMASE will use the IMASE Scenario Generation Tool (ISGT) for scenario generation and the Voice Transmission Tool to support the scenario generation and product development pillars. The IMASE also expects to use the XM-COMSIM with the TRIM Phase II for RF injection of both communications and noncommunications signals for product-generation and delivery requirements.

**(5)** The IMASE development effort is a partnership effort among three organizations. United States Army Operational Test Command (USAOTC) Intelligence Electronic Warfare Test Directorate (IEWTD), Fort Huachuca has the overall IMASE and COMSIM program manager functions and specific expertise for the ISGT. USAOTC Transformation Technology Directorate (TTD) is the product developer for the overall IMASE and IMASE Simulation and Scoring Subsystem (ISSS). Simulation, Training, Instrumentation Command (STRICOM), Threat Systems Management Office (TSMO), is the product developer for ISGT and COMSIM subsystem.

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**Intelligence Modeling and Simulation for Evaluation (IMASE)**
**ACAT: Not Assigned (See M&S Requirements Document Under Separate Cover)**
**Prepared for Milestone III Decision**

Date 15 November 2001

## 1. General Description of Operational Capability.

**a. Statement of Mission Need.** Functional realism of many of today's simulations is insufficient to support both current and future test requirements. Most simulations primarily drive warfighter command and control and staff processes involved with synchronizing combat resources and as such, have limited capability to portray all systems realistically within a constructive event. This limited portrayal creates an artificial environment where activities are unrealistically automated or have unrealistic effects on the SUT. Current intelligence simulation capabilities either provide commanders with "ground truth" without the intelligence system interaction or they lack the robustness needed to reflect the intelligence "system or systems" in a dynamic, extended battle space. Value-added of the SUT to the Commander, to the force structure, and to existing or emerging doctrine is never realistically nor foundationally established since the intelligence system is not realistically stimulated. A great many intelligence-related M&S capabilities used during either testing or training have developed with stove-piped focus, supporting only one functional area or one specific system. These systems evolved because of the inability of the common user and training M&S capabilities to meet the stringent intelligence test requirements. Requirements for information dissemination, traffic volume, timeliness, sensor feeds, classification, situation development, target development, collection management and over all–provision of data that truly reflects value-added contribution of the SUT to the Commander and battle tempo are overlooked or coarsely "roughed-in" to exercises or training events. In testing an intelligence system, the operator must be considered an intricate part of that system. Guidance from the Office of the Director, Operational Test and Evaluation (DOTE), Office of the Secretary of Defense (OSD), has required more interactive play during scenario delivery so as to not only exercise the analyst during the test but to also involve him in the play. The majorities of existing simulations do not involve or focus on the analyst/operator but rather higher-level command and staff functions. IMASE represents the need to maintain, integrate, and further develop test tools and testing environments that will adequately support both the IEW system and the total systems approach to achieving representative and operationally effective combat test environments.

**b. Mission Area Description.** IMASE capabilities may be applied to all aspects of studies and analyses, scenario development, materiel system requirements, doctrine development, training, test and evaluation, readiness assessment, operations planning, strategy development and operations templates – specifying and supporting relationships between IMASE, the Intelligence System Under Test, and other BOS associated with Army and Joint operations.

**(1)** The following are major tasks that apply to the IMASE Mission Area. The scope and depth of supportive interaction will be driven by specific system requirements, the focus of any event, and sponsoring component objectives. They are representative of tasks that define IMASE support to the Strategic, Operational, and Tactical levels of the battlefield:

**(a) Army Tactical Task – ART 2.** IMASE capabilities will directly impact and support development of operational capabilities needed to satisfy Army Tactical Task, ART 2 – Develop Intelligence (ART 2.1 through ART 2.5, inclusive) of the Army Universal Task List (AUTL).

1 Although ART 2 is a common, comprehensive reference point for Intelligence support to the battlefield, it is not an all inclusive, hierarchical listing of Intelligence tasks on or in support of the battlefield.

2 The AUTL is architecturally linked to the Universal Joint Task List (UJTL) and decisively links to the other Battlefield Functional Area (BFA) tasks of: Exercise Command and Control, Deploy/Conduct Maneuver, Employ Firepower, Protect the Force, and Perform Logistics and Combat Service Support. It supports field commanders, combat developers, testers, evaluators, analysts, trainers, and planners for analyzing and integrating operations.

**(b) Specifically SN 7.2 – Conduct Research and Development, Subparagraph SN 7.2.4 – Conduct Testing.** This task provides for the evaluation and assessment of system or material performance appropriate to each phase and milestone of development. This task includes Developmental Test (DT) of alternative concepts and identification of risk. As OT&E, this task is to determine the operational effectiveness and suitability of a system under realistic conditions. Also included in this task is Live Fire Test (LFT). (Joint Pubs 2-0, 3-11, 4-0)

**(2)** Other possible, associated tasks are:

**(a) National Military Strategic Task, SN 6 – Conduct Mobilization, Specifically SN 6.2 – Alert Forces for Mobilization, Subparagraph SN 6.2.4 – Conduct Preparatory Administrative, Logistics, Medical, and Readiness Activities.** This task focuses on initial activities required at mobilization. These include Post mobilization Training Support Requirement (PTSR), command readiness inspection reports, operational test and evaluations, readiness reports, Program Objective Memorandum (POM) processing, the unit training readiness status, and informal evaluation and observations for determining unit-training shortfalls. In addition, combatant commander evaluations of Joint training are considered, as appropriate. (Joint Pubs 4-0, 4-05)

**(b) Theater Strategic Task, ST 7 – Establish Theater Force Requirements and Readiness, Specifically ST 7.1 – Recommend Warfighting and Other Requirements and Test Concepts.** This task focuses on recommendations and prioritization of the theater's peacetime and wartime needs in light of guidance, threat estimates, technology, projected capabilities, resource constraints, and resulting strategy or employment concepts. It includes testing and recommending concepts for mobilizing, deploying, employing, and sustaining the force. (Joint Pubs 5-0, 2-0, 3-0, 4-0)

**(c) Army Tactical Task, ART 5 – Exercise Command and Control, Specifically ART 5.3 – Direct and Lead Subordinates.** This task covers direction of subordinate forces so that they understand and contribute effectively and efficiently to the attainment of the commander's concept and intent. It includes issuing plans and orders, to include intelligence collection plans, essential elements of information, logistics plans, and rules of engagement. Directing includes taking or recommending action to deal with forecasted changes or deviations to accomplish the commander's intent and correcting deviations from the plan or guidance.

**c. Analysis of Nonmateriel Solutions.** Many simulations today, in general, represent narrowly focused, stove-piped developments for each user community. They do not fully meet all component needs; take too long to build; cost too much to develop, operate, and maintain; and are cumbersome to orchestrate, manage, and control. Many have not gone through a thorough Verification, Validation, and Accreditation (VV&A) process nor are their models populated with certified data. For the vast majority, they are not interoperable with other M&S assets that could prove useful within an applied test scope and would preclude redundant development efforts for delivery of interoperable components to a specific test environment. Gradual phase out of large force-on-force exercises, highly structured stand-alone test events, shrinking resources, and the fostered concept of spiral development has resulted in consensus and increased attention and emphasis on M&S products and capabilities to interoperate across service lines, traditional communities, and functions. Achieving full capabilities will require long-term, systematic, coordinated, and focused efforts. IMASE will leverage technologies developed under the Defense Advanced Research Projects Agency (DARPA) and developmental programs, for example, Warfighter's Simulation (WARSIM). IMASE must eventually migrate to or be replaced by WARSIM or the Department of Defense (DOD) M&S capability, however, cost, risk, and performance tradeoffs associated with programs such as WARSIM have degraded WARSIM's capability, for the foreseeable future, to satisfy fidelity requirements associated with IEW operational testing. The IMASE program will closely monitor and implement development of architectures and standards associated with the Defense Modeling and Simulation Office (DMSO) and the Army Modeling and Simulation Office (AMSO) as well as developments under the WARSIM program.

**d. Capstone Requirements Document.** Not Applicable.

**e. System Description.** The IMASE system-of-systems will consist of computer-based battle simulation models that portray the operational environment needed to support the overall Army acquisition process and the events under the SBA and SMART concept and directives. Software models will provide support for test preparation, execution, and reporting in the areas of scenario development, product development, SUT stimulation, and SUT scoring. The IMASE system-of-systems will use a computer-based simulation and associated hardware at the collateral Secret through SCI classification levels. The capability would accommodate live, constructive and virtual requirements; large numbers of object-level (for example equipment and personnel) entities (100K to 150K, neutral, threat, friendly) with their associated intelligence detectables and provide extensive terrain and weather information. The capability will also run one-for-one simulation time within an environment that is flexible, extensible, and supportable throughout a myriad of test and exercise events. The system will be designed to operate in accordance with the emerging HLA standards for advanced distributed simulation to facilitate interoperability with other HLA-compliant simulations, simulators, potential live training events, and provide the capability for quality control of the simulation environment. IMASE will also be compliant with DIS applications using PDU. IMASE data management will be comprised of flexible data structures to interoperate with other databases associated with test support modeling, simulation, and instrumentation. Additionally, IMASE must also be compliant with notional derivatives from national- and service-level databases (for example, National Ground Intelligence Center (NGIC), National Security Agency (NSA), Defense Intelligence Agency (DIA), and Training and Doctrine Command (TRADOC)) required for scenario generation and product development. IMASE will provide flexible and responsive terrestrial and satellite communications gateways and media for transmitting voice, data, facsimile, and video between different elements at remote locations involved in supporting a distributed test event. All architecture components will be VV&A. IMASE will meet Defense Information Infrastructure (DII) Common Operating Environment (COE) and Department of Defense Intelligence and Information System (DODIIS) security standards. All hardware and software components (that include network integration and communications software) will be readily available and serviced through the Standard Army Management Information Systems (STAMIS) directives.

**(1) Defining the Mission.** IMASE system-of-systems will primarily increase the effectiveness and thoroughness of intelligence system operational testing. It will support the acquisition process by generating the fidelity, consistency, and robustness of actual systems within the modeling and simulation environment. In conjunction with other simulations, IMASE will provide the intelligence portion of the overall value-added TOC environment using scenarios, which cover a large range of the live, constructive, and virtual environments. The scenarios will also include the range of military operations within the stages of force projection operations to support globally distributed Army, Joint, and Coalition forces. Additionally, the requirement to provide a realistic threat environment to support Army testing requirements is also accomplished by providing a representative threat force's RF emissions in a manner commensurate with threat doctrine and tactics. A realistic threat environment is critical to the development, modification, and testing of equipment, doctrine, and tactics for current and future U.S. IEW systems. A key area of the threat environment is the ability to provide a multitude of modern communications and non-communications signals to the SUT.

**(2) Operational and Organizational Description.** IMASE will provide simulation capability and support tools to create realistic operational conditions for operational testing and the development of stay-behind Training Support Packages that underpin cradle-to-grave initiatives (for example, SBA) used within the system acquisition process. The program objectives include supporting Total Army and Joint Force events from Battalion through Echelons Above Corps with scenarios from across the operational continuum. It will reduce the resources required to plan, execute, and report on SUT performance during test events executed in a simulation environment. IMASE will support real-time test events in all types of operational environments supporting all IEW BOS. IMASE functional requirements for producing and sustaining a complete simulation environment encompass rapid scenario preparation, generation of supporting products (for example, messages, estimates, reports, overlays), stimulation of the SUT within a supported TOC environment, control of distributed test events, and integrated SUT scoring capability. The requirements for IMASE include the ability to interact with HLA and DIS compliant systems, interact with other constructive simulations, as well as live, instrumented

SUT and test support platforms. Thus, IMASE will provide the constructive simulation shell to surround virtual and live test participants. The functional requirements are based on concepts of using a multi-sensor, sensor-to-shooter, systems-of-systems approach to operational test and evaluation integrating all appropriate ABCS structures and interfaces to prove the "value-added" of the SUT. IMASE will be able to support stand-alone OT&E events or participate through federation in an integrated and/or distributed test or training environment.

**(a) Force Benefit.** IMASE will meet the numerous requirements for providing a testing environment that will allow decision-makers to ensure the SUTs are effective and suitable in supporting the warfighter and its staff in countering threats across the range of military operations. IMASE is a constructive simulation within the RDA domain. As such, its primary use is to support operational testers, evaluators, system contractors, Program Managers (PM), TRADOC System Managers (TSMs), and Developmental Testers. In a secondary role, it may be used to support new units equipped with training support packages using their organizational equipment and employing unit Tactics, Techniques, and Procedures (TTP).

**(b) Employment.** IMASE will provide robust support in the areas of scenario generation, product development, product delivery (system stimulation), and SUT performance scoring. IMASE will provide support to the Joint Surveillance Target Attack Reconnaissance System Common Ground Station (JSTARS CGS) (FY03-FY09), Prophet (FY03-FY09), All Source Analysis System (ASAS) (FY03/05), TUAV (FY03-FY06), Aerial Common Sensor (ACS) (FY05), and beyond. IMASE will provide the primary M&S support structure within an M&S federation.

**(c) Organizational Description.** The IMASE system-of-systems will use computer-based simulation to support all IEW system testing and thereby minimize total overhead associated with operational testing. By nature of its high-fidelity simulation capability, IMASE will also provide improved training opportunities and more interactive scenario play during TOC involvement during testing events. IMASE interface with ABCS systems will completely exercise the SUT and prove the value-added of the SUT to support the operational commander's mission. IMASE, and its associated hardware and software peripherals will operate out of a climate controlled facility or deployed tactical shelter and will provide local or distributed support by means of reliable communications infrastructures. IMASE will support both singular and distributed test environments as well as testing that occurs in a variety of field and climatic conditions. Only two IMASE systems are envisioned, at this time. The need for additional systems may be defined through evolution of test and system support requirements and future customer demands. Two IMASE, six ISGT and eight XM-COMSIM systems are required for operational test support. See Basis of Issue Guidance in Appendix E.

**(3) Other System Interactions. Dependencies.** IMASE will use the ISGT for scenario generation and the VTT to support the scenario generation and product development pillars. IMASE also expects to use XM-COMSIM with the TRIM PII for RF injection of both communications and non-communications signals for the product generation and product delivery requirements.

**(a)** The ISGT has three major requirements in supporting the operational testing community. These requirements are: (1) scenario generation, (2) voice transmission tool, and (3) blue player products. The voice transmission tool would provide the numerous generically structured, but scenario-specific, voice transmissions needed by both IEWTD instrumentation vans and the XM-COMSIM utility to support IEW intercept and direction finding (DF) testing events. As mentioned earlier, residual benefits would also be support to the contractor and training communities.

**(b)** All RF signals, communications and non-communications, shall also be transitioned from the virtual environment to the real world. The digital representation of a propagated signal can be converted to analogue and can be injected into antenna arrays in a hardware-in-the-loop testing environment. Signal generation modules shall be developed to accept the digital representations of signals and to reproduce them in the RF domain to stimulate RF sensors and SUTs. Those signals that are calculated to be within range of a real RF sensor's/system's detection zone shall be reproduced and injected into its antenna port. DF systems using multiple antennas to detect differences in phase/time of arrival shall receive appropriate signals at each antenna port to represent the virtual location of the transmitter entity. The digital representation of signals shall also be used to drive over-the-air simulators that transmit signals as real RF targets for the SUT. The real signals should be high-priority targets from the simulation that are received through the SUT's antenna while injected virtual signals provide the dense RF environment within which the SUT must operate.

**(c)** A signal injection based simulator that can provide thousands of simultaneous legacy and modern, communications and non-communications emissions to the SUT, is required. Signals would be injected directly into the SUT antenna port. This injection process will not interfere with the SUT receiving over-the-air transmissions. Two existing simulator systems each provide a portion of the required capability, the Automated Intelligence/Electronic Warfare Test System (AI/EWTS) Multiple Emitter Capability (AI MEC), and the TRIM. Integration of these two systems should meet IEW operational test requirements. It is proposed to call this new system TRIM PII.

**1** AI/EWTS is a suite of truck mounted, open air, communications simulators that transmit scripted threat scenarios as target RF signals for operational testing of Army Signals Intelligence (SIGINT) systems. AI/EWTS is being upgraded to increase frequency range, and to add modulation capabilities to include modern digital communications, cell phones, and up to 12 independent channels of Frequency Division Multiplex (FDM) transmissions. Augmenting the AI/EWTS truck based systems is a suite of unmanned mini-AI/EWTS currently under development in a project called the AI MEC. These pallets are hardware and software compatible with the truck based AI/EWTS and have the additional capability of multiple simultaneous signals and light wave emissions. The IEWTD Operational Test Control Center (OTCC), utilizing a wireless network, communicates with the test assets providing central control, status reporting, and ground truth data collection. AI/EWTS provides a multitude of communications and some non-communications signals necessary for testing IEW sensors.

**2** TRIM is a synthetic jammer simulator that injects a validated RF waveform, replicating the appropriate threat jammer, at a realistic power level. The system is comprised of four independently controlled RF jamming modules, a receiver, 486 Micro Processor, Power supply, and Global Positioning System(GPS) Unit with antenna all packaged to allow operation while mounted on SUT tactical vehicles in all operational environments. Propagation effects are simulated by one of three methods, Tone Mode, Virtual Mode, and Script Mode. Control Signal Transmitters (CST) control the injected jamming signal when using Tone Mode. CST(s) placed in the field will radiate a tone of known power. The TRIM unit will measure the power level of the tone at the victim radio location and scale the jamming signal input to the victim radio accordingly. In Virtual Mode, the TRIM will determine jamming signal power by using GPS locations and jammer parameters of a remote virtual jammer and the victim radio and calculating path loss via the propagation model, Terrain Integrated Rough Earth Model (TIREM). In this mode, the TRIM input originates at a central control in the form of a DIS, PDU message. The DIS PDU is then reformatted at a communications node, consisting of a wireless RF LAN, and transmitted to the TRIM over the RF LAN. In Script Mode, the TRIM will determine jamming signal power by using scripted GPS locations and other parameters of a virtual jammer and GPS location of the victim radio and calculating path loss via TIREM. In this mode, operational realism is of less importance and all jamming data, including start and stop times is preloaded in the TRIM. Use of the communication node would not be necessary in the scripted mode. TRIM provides the injection methodology and infrastructure along with the virtual jammer capability.

<u>**3**</u> The OTCC consists of three workstations and an RF LAN. It is capable of displaying indications of RF activity based on ground truth instrumentation and the war-gamed scenario. It will accept the DIS PDU messages from the IMASE scenario, translate them into standard commands, and task the TRIM for injection or the AI/EWTS for over-the-air transmission. The OTCC provides real time status of the emitters, SUT, ground truth, and provides the command and control structure for the operational test.

**(d)** Integration and upgrade of XM-COMSIM and TRIM should meet IEW operational test requirements. The XM-COMSIM system will respond to databases created during scenario generation/development that contain multi aspect, high fidelity, validated, threat signature data in appropriate frequencies. Threat data will be available in acoustic, infrared and ultra-violet portions of the spectrum as well as appropriate radio frequencies. They are posted in the Signal Simulation (SIGSIM) Threat Signature Tools and Databases. At the appropriate scenario time, XM-COMSIM identifies and generates high-fidelity RF signals at the appropriate power levels. Propagation calculations create appropriately attenuated primary signals as well as appropriate multi-path signals.

**(e)** Other systems are potentially associated with IMASE, ISGT, and XM-COMSIM. The system descriptions are contained in Annex A.

**f. <u>Supporting Analysis</u>.**

**(1)** During the summer and fall of 2000, the MITRE Corporation was commissioned by USAOTC to conduct an exhaustive study of M&S requirements, capabilities, shortfalls, candidate solution, roadmap and framework investment strategy, and recommendations. The study resulted in a published MITRE technical report, dated December 2000. This report identified IMASE as the candidate solution for the IEW test and evaluation requirements.

**(2)** During the summer of 2000, IEWTD commissioned a study under the Orchestrating Simulations, Models, and Operational Systems for Intelligence Superiority (OSMOSIS) program. Members of Westech, OAO, and the University of Arizona conducted this study. This report identified IMASE as the candidate solution for the IEW test and evaluation requirements.

**(3)** The Threat Systems Management Office conducted two proofs of principle tests for the TRIM system. In the first test, TRIM operated in its virtual mode and in the second test, its control tone mode. Both tests proved the viability of the concept and technology.

**(a)** A study of the feasibility, risks, projected costs, and relevant enabling technologies was performed for IEWTD on the AI MEC project. Electronic Combat Test and Evaluation Company between April and October 2001 conducted this research. This endeavor resulted in the current development effort producing a small, modularized, remotely controlled RF communications simulator with follow-on modules for Infrared signature, MTI radar reflectors, and active image display visual signature. An analysis was performed for the IMASE product delivery requirement. There was no nonmaterial solution identified to provide the function labeled Communications Simulation (COMSIM) . Two materiel solutions were identified and are listed below:

**1** Develop an injection-based simulator that operates like the TRIM system with signal modulation capabilities of the AI MEC.

**2** Procure additional AI MEC emitters and actual foreign systems.

**(b)** An Analysis of Alternatives for the materiel solutions was performed with the following results. There would be a significant difference in cost between solutions one and two. Solution one would require building of a single injection simulator to replicate the capabilities of the AI MEC and many threat systems. Since much of this capability exists within the original TRIM and AI MEC under development, risk is low and costs are reduced. Solution two would not require any development to provide the same signals but would require frequency clearances for all emissions and a significantly higher procurement and operation and maintenance (O&M) costs to deliver the same density. Solution one is the recommended solution for correcting this deficiency.

**g. Command, Control, Communications, and Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR).** IMASE and ISGT will be scalable to support test events ranging from Battalion to multi echelon Corps or Theater. IMASE and ISGT must portray operations in separate theaters, in a two-Major Regional Conflict (MRC) scenario. IMASE and ISGT must support multisided events, where the forces involved may form and change alliances during the conduct of the exercise. Each faction, or force set, must have its own doctrine, equipment, and organization and be capable of adopting postures ranging from overt hostility through strict neutrality to overt cooperation towards each of the other scenario force sets. The minimum number of factions is five at Initial Operational Capability (IOC), expanding to an unlimited number at Full Operational Capability (FOC). The IMASE system must support either one large test event or multiple, small (brigade and below) events. IMASE and ISGT must be extensible, operate within an open systems architecture, and be fully HLA and DIS compliant to ensure interoperability to other simulation systems (WARSIM, Simulation Testing Operations Rehearsal Model (STORM), and Extensible C4I Instrumentation Suite (ExCIS)) to create a larger, multi-theater test event. The level of representation (platform, unit) is a design consideration. IMASE must be able to interface to test units via their Command, Control, Communications, Computers and Intelligence (C4I), ABCS, and communication equipment. The goal is for the simulation to run without the need for role-players.

**h. Evolutionary Development.** IMASE is expected to function under the many aspects of the SBA, SMART, and Simulation, Test and Evaluation Process (STEP) directives and initiatives and to provide support in a cradle-to-grave continuum; contractor testing, developmental testing, operational testing and, when required, stay behind Training Support Packages (TSP).

## 2. Threat.

**a. Threat to be Countered.** The IMASE system is not intended to counter a specific threat.

**b. Projected Threat Environment.** The rapid development and increasing sophistication in information technologies and the resulting vulnerabilities for all C4ISR systems are factors that must be considered by IMASE. Although the primary utility of IMASE will be in the test and analysis environment, its connectivity to operational systems such as ABCS could make IMASE a potential target for information attack. Security precautions (physical procedures, encryption devices, and software safeguards) must be an integral part of system design. Threats to IMASE include physical threats, information collection threats (internal and external), data denial or manipulation threats (introduction of malicious codes or viruses), and reactive threats (identification of system capabilities or dependence could increase the possibilities of countermeasures). Connectivity to telecommunications networks in multiple distributed locations and the incorporation of commercial technologies also hold inherent threat implications for IMASE. Additional information concerning these threats can be found in "C4ISR systems and Networks; and Automated Information Systems (AIS) Threat Environment Description (TED) (U)", DST-2660F-210-94, (U) 15 Jan 94.

## 3. Shortcomings of Existing Systems and C4ISR Architectures.

**a. Shortcomings of Existing Systems.** The current system-of-systems tactical simulation–operational test (TACSIM-OT) used primarily for testing intelligence processing systems (ASAS), Single Source Processor- SIGINT (SSP-S) has become less usable for a number of reasons. Old system technologies (for example code-FORTRAN, flat files, and hardware dependant) have resulted in a lower Return on Investment (ROI) and a system that is becoming increasingly cumbersome. The software design, especially the underlying representation of terrain and weather, precludes representing the detailed functionality required for resolving the high-resolution interactions. These are required to support entity level and object resolution to provide a realistic intelligence picture to the TOC at battalion through corps. TACSIM-OT was never designed to meet the increased SUT sophistication and complexity levels nor the increased emphasis on TOC value-added requirements. Additionally, M&S scenario generation has become too time-consuming. Currently, foundational M&S&I does not have the capability to meet the SUT product generation requirements (for example JVMF, External Data Coordination (EDC) message, graphics, T-UAV, Video EO and IR, JSTARS CGS MTI and SAR, DMS) in a timely manner. Furthermore, TACSIM-OT is not HLA-compliant nor will it interface with other existing, or planned, simulation systems. Shortfalls also exist in RF communications, non-communications, visual, EO/IR acoustic, and signature. The AI/EWTS communications simulators and tactical radio systems on hand at IEWTD require frequency approval for each location where they are utilized. This frequency clearance is sometimes limited to specific times and not all frequencies are granted because of interference with civilian/commercial communication systems. In addition, deployment and operation of an equivalent number of over-the-air systems would be very labor intensive and costly. Finally, these systems still provide a finite number of signals while future Intelligence systems design allows for full operation in an environment of 1000's of signals. XM-COMSIM is expected to fill that augmentation role.

**b. Shortcomings of Existing Modeling and Simulation Architectures.** In general, today's simulations are narrowly focused, stove-piped developments for each user community or respective system that do not fully meet the needs of all potential users of the capability. They are not extensible for use beyond their initial design and may not be reusable. Synthetic environments take too long and cost too much to build and operate nor are they easily maintained. They are not always accredited for their intended capability and use. There is a need to interoperate and reuse models, simulations, and their related products across Service lines, across C4ISR systems, across functions (for example, testing and training) and across classes of models, linking live, virtual, and constructive simulations providing the user with a high fidelity and dynamic environment. Existing communications infrastructures cannot yet provide adequate capacity to lend capability to compile a federated simulation environment that supports a multi-asset approach to a distributed environment. IMASE represents IEW requirements for a high fidelity, tailorable, and extensible test environment.

**4. Capabilities Required.** Operational key performance parameters (KPP) represent significant system capabilities and characteristics. Failure to satisfy them at either IOC (identified by Block I requirements) or FOC (identified by Block II and Block III requirements) configurations will adversely affect system performance and may affect acceptability for use during operational tests, thereby endangering program continuation. The threshold values represent the minimal acceptable value to satisfy the need; objective values are those desired by the user and which the system developers are attempting to obtain. The IMASE acquisition must build upon the successes of the current M&S capabilities of the testing community, thereby enabling an efficient and cost effective testing capability. As a minimum, IMASE must replicate the functional representations and successes of TACSIM-OT. Examples of TACSIM-OT representations required of IMASE are identified in Annex B. Examples of TACSIM-OT representations required of ISGT are identified in Annex C. The acquisition strategy must allow for regular user involvement in the development process. User evaluations and requirements must serve as a primary source for identifying changes to the system.

| Interoperability Key Performance Parameter | | |
|---|---|---|
| | Interoperability KPP | Rationale |
| IMASE and Associated Subsystems<br><br>All Blocks | IMASE shall adhere to all standards and protocols of the Department of Defense (DOD) HLA common technical architecture framework for efficient and effective use of models and simulations to facilitate interoperability and reuse. The technical framework will consist of a common HLA to which all models and simulations must conform, Conceptual Models of the Mission Space (CMMS) to provide a basis for the development of consistent and authoritative simulation representations, and data standards to provide common representation of data across models, simulations, and C4I systems. Furthermore, IMASE developments will adhere to configurable, layered, and reusable software components that will facilitate interoperability of simulations with C4I systems IAW the Defense Information Infrastructure Common Operating Environment (DII COE). | IMASE must interoperate with all types of models and simulations among themselves and with C4I systems to support the needs of operational testing. IMASE must promote flexibility and reuse of models and simulations to support other functional areas. |

| Key Performance Parameter | | KPP Summary Threshold (T) and Objective (O) |
|---|---|---|
| Scenario Generation | Block I | Allow scenario generation for war in accordance with Defense Planning Guidance (DPG). (T)<br>Generate scenarios at the UNCLASSIFIED through the collateral SECRET level. (T)<br>Allow scenario generation for war in Southwest Asia (SWA), Korea, the Balkans and Caspian areas, and for Operations Other Than War (OOTW) in Central and South America and Africa. This includes disaster-relief scenarios in the above locations and in North America. Scenarios will be generated at the UNCLASSIFIED through SCI levels. (O) |
| | Block II | Allow scenario generation for war in Southwest Asia (SWA), Korea, Balkans, Caspian, OOTW in Central and South America and Africa. (T)<br>Allow scenario generation for any operation anywhere in the world in accordance with DPG. (O)<br>Allow users to build and modify scenarios from other sources, for example, One Semi-Automated Forces (OneSAF), JANUS, or Digital Battle Staff Trainer (DBST). (O) |
| | Block III | Allow scenario generation for any operation anywhere in the world in accordance with DPG. (T)<br>Allow users to import and modify scenarios from other sources, for example, OneSAF, JANUS, or Digital Battle Staff Trainer (DBST). (T)<br>Allow users to build and export scenarios to other compatible simulation systems. (O). |
| Product Generation | Block I | IMASE must have the capability to generate USMTF and USSID textual messages. (T)<br>IMASE must have the capabilities to meet the SUT product-generation requirements, for example, JVMF, (T) Electronic Database Coordination (EDC) Message. (O) |
| | Block II | Produce graphics and Defense Messaging System (DMS) products to meet SUT product generation requirements in a timely manner. (T)<br>Produce graphics, TUAV video (EO/IR), CGS MTI and SAR, DMS to meet SUT product generation requirements in a timely manner. (O)<br>XM-COMSIM/TRIM PII development of Timer Ordered Master Events Lists (TOEL) and Script (RF, Textual) (T) |

| Key Performance Parameter | | KPP Summary<br>Threshold (T) and Objective (O) |
|---|---|---|
| | Block III | Produce graphics, TUAV video (EO/IR), CGS MTI and SAR, DMS to meet SUT product generation requirements in a timely manner. (T)<br>Provide stay-behind TSP (T)<br>XM-COMSIM real-time generation (interactivity) of RF and textual script. (O) |
| Product Delivery | Block I | Configure the Scenario Generation and Simulation Application utilizing the Communications Support Processor (CSP). (T)<br>Deliver JVMF messages. (T)<br>Configure the Scenario Generation and Simulation Application. Provide automated tools to configure the software, hardware, and networks that comprise the simulation environment. The simulation configuration includes network design, to include both wide area and local area networks; system parameter selection; location, distribution, and configuration of computers and workstations, whether locally clustered or geographically distributed; and allocation of software to computers based on hardware location and load-balancing across hardware. (O)<br>Provide stay-behind TSP (O) |
| | Block II | Produce capability to execute operational tests in an integrated live and constructive simulation environment. (T)<br>Provide stay-behind TSP (T)<br>Provide capability to execute operational tests in an integrated live, virtual, and constructive simulation environment. (O)<br>XM-COMSIM hardware system development and delivery of script (RF, textual). (T) |
| | Block III | Provide capability to execute operational tests in an integrated live, virtual, and constructive simulation environment. (T)<br>XM-COMSIM provides real-time, virtual (no hardware in-the-loop) delivery capability through the HLA/DIS network. (O) |
| Performance Scoring | Block I | Current capability of Intelligence Portable ASAS Workstation (PAWS) Advanced Graphics Environment (IPAGE), Tactical Simulation (TACSIM) Intelligence Query System (TIQS), and Transmission File Builder (TFB) are required. (T)<br>Minimum requirement is the current capability of TACSIM-OT. (O) |
| | Block II | Demonstrate the capability to process and merge information collected from different simulation environments. (T)<br>Process and merge information collected from different simulation environments, for example, STORM, Virtual Surveillance Target Attack Radar System (VSTARS). (O) |
| | Block III | Process and merge information collected from different simulation environments, for example, STORM, VSTARS. (T) |

**a. System Performance.**

**(1) Block I.** A main requirement of the Block I IOC version of IMASE is to provide no less than the functional equivalence of TACSIM-OT. Functional equivalence is the ability to generate simulation outcomes and outputs of at least the same topical content and level of resolution as the respective legacy simulation.

| Key Performance Parameter | Block I Threshold |
|---|---|
| Scenario Generation | Allow scenario generation for war in accordance with DPG.<br>Generate scenarios at the UNCLASSIFIED through the collateral SECRET level. |
| Product Generation | IMASE must have the capability to generate USMTF and USSID textual messages.<br>IMASE must have the capabilities to meet the SUT product-generation requirements, for example, JVMF. |
| Product Delivery | Configure the Scenario Generation and Simulation Application utilizing the Communications Support Processor (CSP).<br>Deliver JVMF messages. |
| Performance Scoring | Current capability of IPAGE, TIQS, and TFB are required. |

**(a) Key Performance Parameters.**

**1 KPP 1. Scenario Generation.** Generate DPG scenarios at the Unclassified through Sensitive Compartmented Information (SCI) level for war in Southwest Asia, Korea, and the Balkans and Caspian areas; for OOTW for Central and South America and Africa; and for disaster relief in the above locations and in North America. Scenarios are generated from "scratch" or modified from previously generated scenarios. IMASE provides the capabilities to develop and use standardized and tailorable scenario-based target and sensor actuation events. Includes test design; creating graphics or symbols; scenario generation; use of a VTT; development of master events lists (MEL); player products; scoring support applications, for example, high-payoff target list (HPTL); attack guidance matrix (AGM); and production of test support materials. Annex D provides further expansion of KPP requirements.

**Rationale:** Users must be able to rapidly build and change scenarios to quickly establish the simulation environment and support system requirements under numerous operational scopes, contingencies, and domains.

**2 KPP 2. Product Generation.** IMASE must have the capabilities to meet the SUT product-generation requirements (for example, JVMF, EDC).

**Rationale:** Users must be able to rapidly build and adjust products to quickly support the simulation environment and support system requirements under numerous operational scopes, contingencies and domains. Required to more quickly respond to changes in test schedules. Required to support the replication of the user's expected threat doctrinal setting.

<u>3</u> **KPP 3. <u>Product Delivery</u>.** Configure the Scenario Generation and Simulation Application. IMASE must provide automated tools to configure the software, hardware, and networks that comprise the simulation environment. The simulation configuration includes network design, to include both LAN and WAN networks; system parameter selection; location, distribution, and configuration of computers and workstations, whether locally clustered or geographically distributed; and allocation of software to computers based on hardware location and load-balancing across hardware.

**Rationale:** Users must be able to quickly develop and configure communications configurations to quickly support the simulation environment and support system requirements under numerous operational scopes, contingencies and domains. Required to support the replication of the user's expected threat doctrinal setting. Required to more quickly respond to improved capabilities in fielded systems.

<u>4</u> **KPP 4. <u>Performance Scoring</u>.** Minimum requirement is the current capability of TACSIM-OT.

**Rationale:** Users must be able to quickly assess and score system performance to quickly support the environment and support system requirements under numerous operational scopes, contingencies, and domains. Required to duplicate the existing capabilities and lay a foundation for the future.

**(b) <u>Non-KPP Capabilities</u>.**

<u>1</u> **Capability 1.** IMASE simulations must reflect the intelligence detectables and entity attributes across the entire gamut of Army missions. From force protection Stability and Support Operations (SASO), Stability and Support Contingencies (SASC), through High-Intensity Conflict (HIC).

**Rationale:** The scenario must realistically portray real-time operations in a multi-sensor environment, replicating real-time system interfaces. Required to portray a broader cross-section of doctrinal Army missions.

<u>2</u> **Capability 2.** Supporting and interface components and models/simulations interacting with IMASE will be integrated and queued to operational status within approved configurations driven by the operational scenario.

**Rationale:** The scenario must realistically portray a multi-sensor environment, replicating real-time system interfaces.

<u>3</u> **Capability 3.** IMASE will simulate the tactical level combat functions and sub-functions for maneuver, fire support, air defense, command and control, electronic warfare, deception, information operations, signal and automated intelligence sections.

**Rationale:** The simulator outputs must realistically portray functions across multiple BOS to test a broader TOC environment's interactions.

4 **Capability 4.** IMASE and ISGT will provide foundational product-generation outputs with appropriate intelligence detectables needed to support other simulations and models. The support will include authentic threat signatures, variable and formatted messages, low-fidelity state variables and will accurately reflect real-world operational constraints.

**Rationale:** The simulator outputs must realistically portray threat intelligence signatures. Required to support construction of HLA Federations to support testing the SUT across a broader TOC environment.

5 **Capability 5.** IMASE will model unclassified commercial satellites, national systems (Joint Tactical Terminal (JTT)) and Unmanned Aerial Vehicle (UAV) products and operations, including their process for obtaining data and space connectivity.

**Rationale:** The simulator's blue models and must realistically portray friendly capabilities. Required to support the replication of the user's expected threat doctrinal setting.

6 **Capability 6.** IMASE must model use of airlift for forced entry operations to include airdrop, amphibious assaults.

**Rationale:** The simulator must realistically portray operational missions of friendly forces. Required to portray the impact of environmental factors on military operations. Required to portray a broader cross section of doctrinal Army missions.

7 **Capability 7.** IMASE and ISGT must model the Synthetic Environment in that it portrays high-resolution terrain and high fidelity weather.

**Rationale:** The simulator must realistically portray weather and terrain and their effects on friendly and threat forces. Required to portray a broader cross section of doctrinal Army missions.

8 **Capability 8.** IMASE and ISGT must be able to portray a high fidelity level of details as it captures the effects of the individual entities within the battle space including battlefield clutter, congestion, and multiple platform kills.

**Rationale:** The simulator must realistically portray object-level resolution of friendly and threat forces. Required to more quickly respond to improved capabilities in fielded systems. Required to support the replication of the user's expected threat doctrinal setting.

9 **Capability 9.** IMASE and ISGT must portray the effects of night and reduced visibility conditions (to include obscurants) on night operations. Required to more quickly respond to improved capabilities in fielded systems. Required to support the replication of the user's expected threat doctrinal setting.

**Rationale:** The simulator must realistically portray the varying degrees of battle space visibility.

<u>10</u> **Capability 10.** IMASE must allow for the loading and initialization of the primary and secondary simulations.

**Rationale:** The simulator must allow for interaction within it and other simulations.

<u>11</u> **Capability 11.** IMASE product and message generation must be developed to applicable standards. Required to support the replication of the user's expected threat doctrinal setting. Required to support construction of HLA federations to support testing the SUT across a broader TOC environment.

**Rationale:** The simulator must realistically provide Army Battle Command System products with an emphasis on the intelligence BOS.

<u>12</u> **Capability 12.** IMASE SUT performance scoring capability must: concurrently create, retrieve, display and distribute real-time SUT scoring products; produce data collection forms; provide an unconstrained view of the battle space; support the ASAS Data and Recording System (ADARS); support scoring of Situation Development, Target Development, Situation Awareness, Collection Management, Battle Damage Assessment, and Asset Status and Tracking.

**Rationale:** The simulator must accurately develop and present a scoring and After-Action Report (AAR) capability. Required to provide objective data to support the evaluation of the SUT.

<u>13</u> **Capability 13.** ISGT must provide a visualization capability to support both scenario generation and white cell operations that include storage, retrieval, and display at variable speeds. This capability is for both quality control and operational purposes.

**Rationale:** The simulator must accurately develop means visualization for quality control and operational purposes.

<u>14</u> **Capability 14.** IMASE, ISGT, and XM-COMSIM will automatically archive information into, and access archived information from appropriate repositories.

**Rationale:** The simulator must accurately archive historical scenario information. Required to conform to Army Regulation 73-1 that requires maintenance of test data for up to five years.

<u>15</u> **Capability 15.** IMASE & ISGT must facilitate and assist test event planning in conjunction with scenario preparation, simulation configuration, product development, delivery and SUT performance scoring by identifying all M&S resources for pretest, test and post test event requirements.

**Rationale:** The simulator must accurately provide event requirements. Required to provide objective data to support the evaluation of the SUT. Required to support the replication of the user's expected threat doctrinal setting. Required to more quickly respond to changes in test scheduling.

<u>16</u> **Capability 16.** IMASE, ISGT, and XM-COMSIM will provide a technical control capability for their respective systems by monitoring the system performance, fault prediction and detection and restarts.

**Rationale:** The simulator must provide mechanisms for simulation control and performance. Required for the VV&A of components.

<u>17</u> **Capability 17.** IMASE should have a .95 $A_o$ for up to 135-hours of simulation.

**Rationale:** The simulation must have minimal outages. Required to insure successful execution of scheduled events.

<u>18</u> **Capability 18.** IMASE must be able to interface to and interact with simulated units via C4I, ABCS, and communications equipment without role players.

**Rationale:** The simulation must accurately replicate information to/through equipment that are both present and absent. Required as a cost avoidance measure and to avoid increases in table of distribution and allowances (TDA) manning.

<u>19</u> **Capability 19.** IMASE and ISGT must be extensible and inter-operate with simulations such as WARSIM, ExCIS, STORM, and Command, Control, Communications, and Intelligence (C3I) Engineering and Evaluation System (CEES) via HLA.

**Rationale:** The simulation must accurately interface with other modeling and simulation federations. Required to support construction of HLA federations to support testing the SUT across a broader TOC environment. Required to support the replication of the user's expected threat doctrinal setting.

<u>20</u> **Capability 20.** IMASE and ISGT must support multisided exercises where involved forces may form and change alliances (up to five factions (force sets)) during the event.

**Rationale:** The simulation must accurately reflect multiple and changing alliances. Required to support the replication of the user's expected threat doctrinal setting. Required to portray a broader cross section of doctrinal Army missions.

<u>21</u> **Capability 21.** IMASE must support communications via fielded C4I equipment using valid message formats and in accordance with established interface standards within the synthetic environment.

**Rationale:** The simulation must accurately and realistically reflect C4I communications, strengths, and shortfalls. Required to support the replication of the user's expected threat doctrinal setting.

__22__ **Capability 22.** IMASE must be able to operate in collateral Secret mode through special compartmented levels and meet the requirements for a trusted computer system based on DOD 5200.28.STD, DOD Trusted Computer Evaluation Criteria.

**Rationale:** The simulation must be able to operate at multiple security levels. Required to support the replication of the user's expected threat doctrinal setting.

__23__ **Capability 23.** IMASE and ISGT must incorporate sophisticated protection against unauthorized access to the simulation system and theft, corruption or destruction of software or data.

**Rationale:** The simulation must be secure from computer network attack.

__24__ **Capability 24.** IMASE and ISGT will have a data loss prevention which dictates that whatever is not "backed up" by a data logger will have an auto save feature, allowing the recovery of unsaved changes in the event of system failure.

**Rationale:** The simulator must be exempt from data loss. Required to insure successful execution of scheduled events. Required to conform to Army Regulation 73-1 that requires maintenance of test data for up to five years.

**(2) __Block II__.**

| Key Performance Parameter | Block II Threshold |
|---|---|
| Scenario Generation | Allow scenario generation for war in Southwest Asia (SWA), Korea, Balkans, Caspian, OOTW in Central and South America and Africa. |
| Product Generation | Produce graphics and Defense Messaging System (DMS) products to meet SUT product generation requirements in a timely manner. |
| Product Delivery | Produce capability to execute operational tests in an integrated live and constructive simulation environment.<br>Provide stay-behind TSP.<br>XM-COMSIM/TRIM PII hardware system development and delivery of script (RF, textual). |
| Performance Scoring | Demonstrate the capability to process and merge information collected from different simulation environments. |

**(a) __Key Performance Parameters__.**

__1__ **KPP 1. __Scenario Generation__.** The FOC requirement is to Allow scenario generation for any operation anywhere in the world in accordance with DPG.

**Rationale:** Users must be able to rapidly build and change scenarios to quickly establish the simulation environment and support system requirements under many operational scopes, contingencies, and domains. Required to support the replication of the user's expected threat doctrinal setting. Required to more quickly respond to changes in test schedules. Required to portray a broader cross section of doctrinal Army missions.

2 **KPP 2. Product Generation.** IMASE must have the capabilities to meet the SUT product-generation requirements (for example, JVMF, EDC, graphics, TUAV video (EO/IR), CGS MTI and SAR, DMS) in a timely manner.

**Rationale:** Users must be able to rapidly build and adjust products to quickly support the simulation environment and support system requirements under numerous operational scopes, contingencies and domains. Required to support the replication of the user's expected threat doctrinal setting. Required to more quickly respond to changes in test schedules.

3 **KPP 3. Product Delivery.** Configure the Scenario Generation and Simulation Application. IMASE must provide automated tools to configure the software, hardware, and networks that comprise the simulation environment. The simulation configuration includes network design, to include both LAN and WAN networks; system parameter selection; location, distribution, and configuration of computers and workstations, whether locally clustered or geographically distributed; and allocation of software to computers based on hardware location and load-balancing across hardware.

**Rationale:** Users must be able to quickly develop and configure communications configurations to quickly support the simulation environment and support system requirements under numerous operational scopes, contingencies and domains.

4 **KPP 4. Performance Scoring.** Process and merge information collected from different, for example, STORM, VSTARS, simulation environments.

**Rationale:** Users must be able to quickly assess and score system performance to quickly support the environment and support system requirements under numerous operational scopes, contingencies, and domains.

**(b) Non-KPP Capabilities.**

1 **Capability 1.** IMASE will simulate the tactical level combat functions and sub-functions for maneuver, fire support, air defense, command and control, electronic warfare, deception, information operations, and signal and automated intelligence sections.

**Rationale:** The simulator outputs must realistically portray functions across multiple BOS. Required to support the replication of the user's expected threat doctrinal setting. Required to provide objective data to support the evaluation of the SUT.

2 **Capability 2.** IMASE and ISGT will provide foundational product-generation outputs with appropriate intelligence detectables needed to support other simulations and models. The support will include authentic threat signatures, variable and formatted messages, low-fidelity state variables and will accurately reflect real-world operational constraints. Required to provide objective data to support the evaluation of the SUT.

**Rationale:** The simulator outputs must realistically portray threat intelligence signatures. Required to support the replication of the user's expected threat doctrinal setting. Required for the VV&A of components.

<u>3</u> **Capability 3.** IMASE and ISGT must portray the capability of all units to modify the battle space (and supporting infrastructure) with respect to mobility, counter-mobility, survivability, and sustainment engineering. Nuclear, biological and chemical (NBC) and enemy prisoners of war (EPW) are also included in this capability.

**Rationale:** The simulator must allow battle space and infrastructure manipulation in order to support the replication of the user's expected threat doctrinal setting.

<u>4</u> **Capability 4.** IMASE must model use of airlift for forced entry operations to include airdrop, amphibious assaults and simulate special operational forces such as Army Special Forces, Rangers, Special Operations Aviation, and Civil Affairs.

**Rationale:** The simulator must realistically portray operational missions of friendly forces in order to support the replication of the user's expected threat doctrinal setting and portray a broader cross section of doctrinal Army missions.

<u>5</u> **Capability 5.** ISGT must allow player units supporting training and test events to interact with units, including cognitively, in the absence of other units while minimizing the number of personnel controlling the simulated units (automated forces).

**Rationale:** A minimum number of personnel must realistically portray simulator outputs.

<u>6</u> **Capability 6.** IMASE SUT performance scoring capability must be able to seamlessly link with SUT scoring systems (for example, TIQS, IPAGE, visualization tool)used in geographically dispersed live and other constructive simulation environments (for example, STORM, VSTARS). Linkage may be made by T-1 or Asynchronous Transfer Mode (ATM) network to a data logger or other application.

**Rationale:** The simulator must accurately develop and present a scoring and AAR capability in order to provide objective data to support the evaluation of the SUT.

<u>7</u> **Capability 7.** ISGT must provide a visualization capability to support both scenario generation and white cell operations that will allow the Wargamer and scenario generators to navigate through replays by providing a real-time capability to fast forward, move forward or backward directly from one point in time to another, or move forward or back in specified time increments.

**Rationale:** The simulator must accurately develop a means of visualization for quality control and operational purposes. This is required for the VV&A of components, to support the replication of the user's expected threat doctrinal setting, and to portray a broader cross section of doctrinal Army missions.

__8__ **Capability 8.** IMASE and ISGT must support multisided exercises where involved forces may form and change alliances (unlimited number of factions (force sets)) during the event.

**Rationale:** Required to portray a broader cross section of doctrinal Army missions. Required to portray a broader cross section of doctrinal Army missions. Required to support the replication of the user's expected threat doctrinal setting.

__9__ **Capability 9.** IMASE must support communications via fielded C4I equipment using valid message formats and in accordance with established interface standards within the synthetic environment. It must portray the effects of Electronic Warfare (EW) on threat and friendly communications, radar, operations, and the effects of information operations on the SUT.

**Rationale:** The simulation must accurately and realistically reflect C4I communications strengths, shortfalls. Required to support the replication of the user's expected threat doctrinal setting. Required to portray a broader cross section of doctrinal Army missions. Required to insure successful execution of scheduled events.

__10__ **Capability 10. The** XM-COMSIM system shall operate under two (2) control modes: virtual and scripted. Virtual mode uses GPS locations of the virtual emitter and victim in conjunction with a propagation model to determine signal power. In the virtual mode, the XM-COMSIM input originates at the OTCC in the form of a DIS PDU message. The DIS PDU is then reformatted at a communications node, consisting of a wireless RF LAN, and transmitted to the XM-COMSIM over the RF LAN. When used in the scripted mode, operational realism is of less importance and all signal data, including start and stop times is preloaded in the XM-COMSIM. Use of the communication node would be precluded in the scripted mode.

**Rationale:** This requirement is to allow for different modes of operation based on differing levels of operational test need. Required to support the replication of the user's expected threat doctrinal setting. Required to provide objective data to support the evaluation of the SUT. Required to support construction of HLA federations to support testing the SUT across a broader TOC environment.

__11__ **Capability 11.** The design of the XM-COMSIM system shall accommodate expansion and/or modification to replicate future communications and noncommunications systems.

**Rationale:** This requirement is to ensure that future signal developments are capable of being replicated without additional simulator procurements and support the replication of the user's expected threat doctrinal setting.

__12__ **Capability 12.** The XM-COMSIM shall be capable of operating on 24 volts DC vehicle power directly. These units shall also have allowances (external) for the optional power sources of 120 VAC and battery pack.

**Rationale:** The simulator will not have any other power source when mounted on tactical vehicles for extended periods during execution of its primary mission. Alternate uses for the simulator include laboratory based testing and classroom based training.

<u>13</u> **Capability 13.** The XM-COMSIM system shall be capable of simulating emitters in the frequency range of 2 - 2500 MHz initially and up to 40 GHz in the future.

**Rationale:** These frequency ranges cover the capability of the Prophet Blocks I-III and the capability of future systems such as Prophet Blocks IV-V, Division Tactical Unmanned Aerial Vehicle SIGINT Program (DTSP), and ACS.

<u>14</u> **Capability 14. The** XM-COMSIM shall be capable of storing digital terrain data, waveform characteristics, signal parameters and all operating software without the use of external storage devices. The internal storage shall be removable for proper storage of sensitive/classified signals/parameters.

**Rationale:** The simulator must be capable of operating in the virtual mode without controller input. Additionally the simulator shall be required to retain instrumentation data in order to provide objective data to support the evaluation of the SUT.

<u>15</u> **Capability 15. The** XM-COMSIM electromagnetic interference (EMI) shall not exceed -95 dBm.

**Rationale:** This requirement is to ensure that the simulator does not interfere with the electronics of other deployed systems.

<u>16</u> **Capability 16.** For conducting virtual jamming, the XM-COMSIM must be capable of sensing RF activity and provide feedback to the OTCC.

**Rationale:** This requirement is to ensure operational threat realism and automated operation to support the replication of the user's expected threat doctrinal setting.

<u>17</u> **Capability 17. The** XM-COMSIM system should be HLA compliant (objective requirement).

**Rationale:** In order to integrate with other simulations currently in use in testing, XM-COMSIM must eventually be HLA compliant to support construction of HLA federations to support testing the SUT across a broader TOC environment.

**(3) Block III.**

| Key Performance Parameter | Block III Threshold |
|---|---|
| Scenario Generation | Allow scenario generation for any operation anywhere in the world in accordance with DPG.<br>Allow users to import and modify scenarios from other sources, for example, OneSAF, JANUS, Combat Synthetic Test and Assessment Range (CSTAR), or Digital Battle Staff Trainer (DBST). |
| Product Generation | Produce graphics, TUAV video (EO/IR), CGS MTI and SAR, DMS to meet SUT product generation requirements in a timely manner. |
| Product Delivery | Provide capability to execute operational tests in an integrated live, virtual, and constructive simulation environment. |
| Performance Scoring | Process and merge information collected from different simulation environments, for example, STORM, VSTARS. |

**(a) Key Performance Parameters.**

**1 KPP 1. Scenario Generation. The** Post-FOC requirement is to Allow scenario generation for any operation anywhere in the world in accordance with DPG.

**Rationale:** Users must be able to rapidly build and change scenarios to quickly establish the simulation environment and support system requirements under many operational scopes and contingencies. Required to support the replication of the user's expected threat doctrinal setting. Required to portray a broader cross section of doctrinal Army missions.

**2 KPP 2. Product Generation.** IMASE must have the capabilities to meet the SUT product-generation requirements (for example, JVMF, EDC, graphics, TUAV video (EO/IR), CGS MTI and SAR, DMS) in a timely manner.

**Rationale:** Users must be able to rapidly build and adjust products to quickly support the simulation environment and support system requirements under numerous operational scopes, contingencies and domains. Required to support the replication of the user's expected threat doctrinal setting. Required to portray a broader cross section of doctrinal Army missions. Required to support construction of HLA federations to support testing the SUT across a broader TOC environment.

**3 KPP 3. Product Delivery.** IMASE must be able to configure the scenario generation and simulation application by providing automated tools to configure the software, hardware, and networks that comprise the simulation environment. The simulation configuration includes network design, to include both LAN and WAN networks; system parameter selection; location, distribution, and configuration of computers and workstations, whether locally clustered or geographically distributed; and allocation of software to computers based on hardware location and load-balancing across hardware.

**Rationale:** Users must be able to quickly develop and configure communications configurations to quickly support the simulation environment and support system requirements under numerous operational scopes, contingencies and domains. Required to support construction of HLA federations to support testing the SUT across a broader TOC environment. Required to more quickly respond to changes in test schedules. Required to more quickly respond to improved capabilities in fielded systems.

4 **KPP 4. Performance Scoring.** Process and merge information collected from different, for example, STORM, VSTARS, simulation environments.

**Rationale:** Users must be able to quickly assess and score system performance to quickly support the environment and support system requirements under numerous operational scopes, contingencies, and domains. Required to support the replication of the user's expected threat doctrinal setting. Required to support construction of HLA federations to support testing the SUT across a broader TOC environment. Required to provide objective data to support the evaluation of the SUT. Places increased emphasis on use of a federated systems approach in support of TOC operations.

**(b) Non-KPP Capabilities.**

1 **Capability 1.** IMASE and ISGT must cause simulated mistakes and accidents at the option of the Wargamer.

**Rationale:** The simulator must realistically reflect battlefield conditions and responses to accurately test the SUT. Required to support the replication of the user's expected threat doctrinal setting. Required to portray a broader cross section of doctrinal Army missions. Required to portray the impact of environmental factors on military operations.

**b. Information Exchange Requirements.** Interoperability, interface and information exchange requirements are depicted at Table B.

**c. Logistics and Readiness.** Logistical support for IMASE will be based on a government-owned, contractor-supported system. The government will own necessary hardware, will have all proprietary rights to the developmental hardware and software components, and will have full license rights to the non-developmental software components of IMASE. Contracted logistical support will provide for the operation and maintenance of government-owned computer hardware and software.

**d. Reliability and Maintainability (R&M).** System should operate at the 95 percent readiness level for up to 135-hours of simulation

**(1)** Each system component of the IMASE and ISGT will have a redundant power backup capability and automatic save feature, allowing for a graceful system shutdown in the event of a power failure. Standard COTS batteries will be used in all systems where there is a requirement for battery power, for example, computer system clocks.

**(2)** XM-COMSIM will have an Operational Availability ($A_o$) of 0.90. The $A_o$ requirement is driven by the limited number of systems available and the negative impact on test schedules that equipment failure will produce.

**(3)** The XM-COMSIM will have a Mean Time to Repair (MTTR) of 1.0 hour. This MTTR is the result of maintenance manpower and maintenance ratio limitations.

**(4)** The XM-COMSIM will have a Mean Time Between Operational Mission Failures (MTBOMF) greater than 100 hours for a continuous 96-hour training/testing period. MTBOMF has been determined by mission reliability constraints.

**e. Environmental, Safety and Occupational Health (ESOH) and Other System Characteristics.**

**(1) Electronic Attack.** IMASE, being an automated system, is subject to Information Warfare (IW) activities to include, but not limited to, denial of service, unauthorized monitoring and disclosure of sensitive information, and unauthorized modification of databases and services. IMASE must meet the requirements for a trusted computer system based on DOD 5200.28.STD, DOD Trusted Computer Evaluation Criteria**.** IMASE and ISGT must incorporate sophisticated protection against unauthorized access to the simulation system and theft, corruption or destruction of software or data.

**(2) Nuclear, Biological, and Chemical (NBC).** There are no NBC survivability requirements associated with IMASE.

**(3) Natural Environment.**

**(a)** Support for environmental support and reporting is tasked to the agency responsible at each testing site. No requirement will exist for any specific weather, oceanographic or astrogeophysical support.

**(b)** Although the typical IMASE configuration is within a controlled environment shelter, IMASE must operate throughout environmental extremes, on Army-wide installation sites, and while deployed. Operational environments may include operation from climate-controlled tactical shelters with outer atmospheric effects of extreme heat and cold, dust and humidity.

**(c)** System safety requires that the IMASE system shall be capable of safe operation without hazards to personnel or equipment. Conflicts regarding safety versus authenticity shall be resolved in favor of safety and documented by statements indicating the impact on authenticity. IMASE must meet applicable Occupational Safety and Health Administration (OSHA) safety and health standards, including hazards to users, operators, maintainers, and personnel adjacent to the system. IMASE will comply with applicable industry and Government standards to ensure it is safe to operate and maintain.

**(d)** Health Hazard Assessment (HHA). The IMASE system shall present no uncontrolled health hazards to personnel. Conflicts between health requirements and threat system authenticity shall be resolved in favor of good health considerations and shall be fully documented. The system shall be free of any condition inherent to the operation or use of materials that can cause death, injury, acute or chronic illness, disability, or reduced job performance. Compliance with industry and government health hazard standards is required. IMASE must not present uncontrolled noise, toxic, or radiation hazards. Health hazard areas of consideration include: Chemical substances (batteries, immediate feedback devices, shelter fire extinguishing agents), temperature extremes, oxygen deficiencies (ventilation), acoustic energy (impulse and steady-state noise) and radiation energy (laser, broadband optical radiation and radio frequency radiation (RFR)).

**(4) Unplanned Stimuli.** Each model, simulation, and/or automated utility will be operated with a redundant power source and be designed to allow for graceful software shutdowns in the event of a power failure.

**(5) Expected Mission Capability.** IMASE must support tests up to theater-level with one or more echelons within primary focus of the SUT. Test support includes consideration for the size of the test, the focus of the event, the tools provided, and system reliability over the duration of a standard test. Two separate instances of IMASE (or IMASE operating within a federated simulation environment) must be able to link together to allow for multi-echelon operations within the same test location or in geographically separate locations, without degradation of either system performance nor adversely impact data collection or system evaluation. ISGT must build scenarios from scratch within 4 to 6 months for a 350 km X 350 km play box containing 150k entities. IMASE and ISGT must tailor existing scenarios in half the time when initially fielded. The scoring utilities and tools must provide analysts a set of automated aids to plan, prepare, and conduct assessments and evaluations during simulation execution without affecting the IMASE, nor the SUT's, performance or reliability. The simulation itself, as a testing tool, must provide a level of fidelity of outputs and reports tailorable to the test focus and be able to satisfactorily answer Critical Operational Issues and Criteria (COIC) allowing testers and evaluators to accomplish these tasks under the conditions and standards referenced in the corresponding test documentation. IMASE must operate with no degradation that exceeds the composite Ao of .95 in all environs of fixed facility or deployed and distributed site configurations.

**(6) Physical and Operational Security Needs.** Security Levels. IMASE must be able to operate in a collateral Secret mode and accommodate multi security-level requirements for training with classified data in classified scenarios. This includes the capability to transmit classified data over the distributed network or to use classified data as part of the model parameters in a classified database, media storage, purging of classified data from systems, or denial of unauthorized users. Required classification levels include SECRET for the bulk of the system and Top Secret/Sensitive Compartmented Information (TS/SCI) for intelligence models. Data used by IMASE and ISGT will have security levels ranging from unclassified to TS/SCI. Products produced may be from the Unclassified through SCI classification levels. A DIA-approved method of executing different security levels at the same time shall be provided in IMASE and ISGT. IMASE and ISGT must meet the requirements for a trusted computer system based on DOD) 5200.28.STD, DOD Trusted Computer Evaluation Criteria**.** IMASE and ISGT must incorporate sophisticated protection against unauthorized access to the simulation system and against theft, corruption or destruction of software or data. Both IMASE and ISGT will have the ability to overwrite, clear, purge, and transfer classified data in accordance with NSA standards with NSA approved equipment. Each software component of the IMASE and ISGT will have a redundant backup capability and automatic save feature, allowing for the recovery of unsaved changes in the event of system failure.

**(7) Electromagnetic Environmental Effects.**

**(a)** IMASE and its associated components must have full electromagnetic compatibility with existing tactical communications, electrical and electronic equipment to include all military aircraft and ground systems used globally.

**(b)** XM-COMSIM and TRIM PII must be designed to minimize use of the RF spectrum, and maximize use of the tactical spectrum. It must be adjustable or tunable to accommodate Army or worldwide applications. XM-COMSIM and TRIM PII must comply with Department of Defense (DoD) spectrum management polices and procedures.

## 5. Program Support.

### a. Maintenance Planning.

**(1)** The support concept for the IMASE, ISGT, and XM-COMSIM will be determined through an analysis of reasonable alternatives. Any maintenance plan developed must cover all users and not leave the users to arrange for their own maintenance. The concept will be modified based on analysis of fixed site and deployed and/or distributed requirements and will not degrade IMASE's intended operational test support mission. The support concept will be inclusive of operator, organizational, intermediate, and depot-level support levels.

**(2)** Initial support for the XM-COMSIM will be provided by IEWTD. IEWTD contractor personnel will perform operator, organizational and intermediate support, and depot level maintenance of the XM-COMSIM devices. IEWTD's contractor personnel will seek technical assistance from the simulator materiel developer as needed.

### b. Support Equipment.

**(1)** IMASE and ISGT will be designed to be maintained by standard Test, Measurement, Diagnostic Equipment (TMDE) equipment and will include fault isolation capabilities to diagnose failures at a level commensurate with the final support concept.

**(2)** Support Equipment (SE) and TMDE identified by Original Equipment Manufacturer (OEM) and procured to support IMASE and its components will be maintainable and supportable by the appropriate-level operator/maintenance personnel, and maximize commercially equivalent Government Furnished Equipment (GFE) equipment when practical/cost effective.

**(3)** SE operator and maintenance documentation, whether commercial or OEM-unique equipment, will be provided.

**c. <u>C4I Standardization, Interoperability, and Commonality</u>.** IMASE and ISGT will be scalable to support test events ranging from Battalion to multi echelon Corps or Theater. IMASE and ISGT must portray operations in separate theaters, in a two-MRC scenario. IMASE and ISGT must support multisided events, where the forces involved may form and change alliances during the conduct of the exercise. Each faction, or force set, must have its own doctrine, equipment, and organization and be capable of adopting postures ranging from overt hostility through strict neutrality to overt cooperation towards each of the other scenario force sets. The minimum number of factions is five at IOC, expanding to an unlimited number at FOC. The IMASE system must support either one large test event or multiple, small (brigade and below) events. IMASE and ISGT must be extensible, operate within an open systems architecture, and be fully HLA and DIS compliant to ensure interoperability to other simulation systems (WARSIM, STORM, and ExCIS) to create a larger, multi-theater test event. The level of representation (platform, unit) is a design consideration. IMASE must be able to interface to and interact with simulated units via their C4I, ABCS, and communication equipment. The goal is for the simulation to run without the need for role-players.

**(1)** Test event player personnel will use their organizational ABCS devices for all incoming and outgoing communications, data transfer, and simulation interaction. IMASE must be able to send and receive information in the appropriate format using the media employed by the SUT.

**(2)** The system must comply with applicable provisions contained in the Joint Technical Architecture (JTA) to include DII COE compliance.

**(3)** IMASE and ISGT must interface with Force XXI Battle Command - Brigade and Below (FBCB2), Army Tactical Command and Control System (ATCCS), Army Global Command and Control System (AGCCS), Standard Theater Army Command and Control System (STACCS), and the Army World-Wide Military Command and Control System (WWMCCS) Information System (AWIS) communications. IMASE and ISGT will have a means for allowing the SUT player unit to interact with the simulation when the simulation interface is beyond the unit's tactical communications range.

**(4)** IMASE must support communications over fielded C4I equipment using valid message formats. All communications must pass through the simulation environment to determine if communication is possible within the synthetic environment. Live-to-simulated unit, simulated-to-live unit, simulated-to-simulated unit, and live-to-live unit communications may be subjected to information attack, jamming, interference, interception, and range considerations as determined by synthetic environment activities.

**(5)** As a Test and Evaluation support system, IMASE will not be integrated into the Army's C4I architecture, but will leverage and collect data from and provide input to both the SUT and the associated tactical C4ISR systems. System will be COE compliant to allow integration of future SUTs and C4I supported systems.

**(6)** IMASE will provide operational testers with instrumented test capabilities that are fully interoperable within the COE. Simulation system components will be interoperable within the HLA's family of simulation systems. Equipment commonality will provide functional standardization to support "seamless" transition from local fixed site to deployed and/or distributed environment. IMASE will leverage established DOD M&S protocols and standards to ensure complete interoperability for both communications and data exchange

**(7)** The XM-COMSIM system shall be compatible with existing and planned threat simulator command and control systems and be capable of being integrated into existing High Frequency (HF), Very High Frequency (VHF), Ultra High Frequency (UHF), and wire communications networks.

**(8)** IMASE and its interface components and devices will be installed in pre-approved configurations that meet event and exercise objectives and do not degrade the performance of the SUT, associated war-fighting platforms or interfaced systems supporting the conduct of synthetic testing or training.

**d. Computer Resources.** The System Components Suites IMASE Computer Suite (ICS) is comprised of modular and scalable components consisting of the computer processor unit (CPU), technical and functional control workstations, preprocessor and post processor software, databases, battle models, communications network equipment, to include the physical and wireless LAN and WAN and ancillary software modules. Each ICS must be capable of being configured to meet the specific testing requirements in terms of population, echelon of command, and operational missions of the units being supported by a particular site.

**(1)** The simulation system will comprise an open system architecture and must comply with emerging standards for HLA (IOC) and Portable Operating System Interface (POSIX)-compliant operating systems.

**(a)** The simulation software must be designed in a modular fashion that permits distributed computing.

**(b)** Standards and protocols must be designed in such a way that distinct models can have individual model configuration control. The requirement is for each model to be designed so that it can be changed and improved without affecting the design of the other models comprising the simulation system. This includes all IMASE, ISGT and XM-COMSIM support functions, such as scenario generation, test event planning, product development (messaging and communications and noncommunications) the battle models/simulation, surrounding forces, opposing forces (OPFOR) representation, linkages to tactical communications or the replication of communications, technical control, and SUT performance scoring requirements.

**(2)** Analytical Quality Algorithms. IMASE and ISGT shall make maximum use of analytical quality algorithms and Army standard algorithms where available and practical to implement.

**(3)** The IMASE and ISGT system must have the capability to use, manipulate, input data to, and extract data from a variety of databases to include organizational system databases and standard Army management information systems using standard commercial or government off-the-shelf database management systems.

**(a)** An upload and download information capability must be available by stand-alone personal computer to facilitate the database build process.

**(b)** The IMASE and ISGT databases must be capable of being readily modified between test events to handle data for systems of any nation.

**(c)** IMASE, ISGT, and XM-COMSIM must have appropriate systems and user documentation in accordance with Institute of Electrical and Electronics Engineer (IEEE) 12207 standards.

**(d)** The software comprising IMASE and ISGT must be documented to support a thorough process of maintenance, enhancement, upgrade support, and VV&A.

**(4)** The simulation's model parameters must be designed so that all data; for example, parameters for system performance, rules for expert systems, addresses for network nodes, are not part of the simulation software itself. IMASE and ISGT must allow changes in scenarios, input parameters, rules, network structures, during a test event with minimal disruption to the exercise.

**(5)** IMASE and ISGT will be compliant with the current version of the DOD HLA and Runtime Infrastructure (RTI) and easily upgradeable as these standards evolve. IMASE and ISGT will use the HLA RTI to interoperate with similarly compatible Army and other service virtual simulators, constructive simulations, and live instrumented training facilities.

**(a)** When interoperating with other simulation environments containing duplicate functionality, IMASE will be able to selectively disable its organic functionality. It will also be able to provide functionality to the other environments.

**(b)** IMASE will be able to selectively activate and deactivate linkages to other simulations and simulators while a test event is in progress without disrupting the current test event.

**(c)** Per DOD 5000.59-M, DOD Modeling and Simulation Glossary, seamless is defined as "perfectly consistent". Transparent and interoperable is defined as "The ability of a model or simulation to provide services to and accept services from other models and simulations, and to use the services so exchanged to enable them to operate effectively together." For the purpose of this ORD, interoperability between IMASE and ISGT includes the following specific interactions capability: (a) correlation of terrain models to ensure common location across simulations; (b) arbitrate differing levels of resolution to ensure a level playing field (also known as fair fight); (c) resolve Line of Sight (LOS) entities in the separate simulations in a realistic manner; (d) have the ability to migrate individual entities across the simulation boundaries (move from ISGT and IMASE and vice versa); (e) arbitrate aggregation and deaggregation between the two simulations to maintain the level playing field; (f) correlate databases to correct for differences in physical measurement and methods for quantification of database elements; (g) resolve differences in the fidelity of individual models between the two simulations. The test event player unit will see no difference in stimulation and interaction with units portrayed within the simulation environment.

**(d)** The simulation must be capable of operating one-for-one with real time and operating up to multiple factors faster than real time. Simulation will not fall behind more than 1 minute (desired), 3 minutes (acceptable) per hour before it has caught up and is operating one-for-one.

**(6)** IMASE must be able to operate in a collateral Secret mode and accommodate multi security-level requirements for use of classified data in classified scenarios. This includes the capability to transmit classified data over the distributed network or to use classified data as part of the model parameters in a classified database, media storage, purging of classified data from systems, or denial of unauthorized users. Required classification levels include SECRET for the bulk of the system and TS/SCI for intelligence models. Data used by IMASE and ISGT will have security levels ranging from unclassified to TS/SCI. Produced products may be from the Unclassified through SCI classification levels. A DIA-approved method of executing different security levels at the same time shall be provided in IMASE and ISGT. IMASE and ISGT must meet the requirements for a trusted computer system based on DOD) 5200.28.STD, DOD Trusted Computer Evaluation Criteria**.** IMASE and ISGT must incorporate sophisticated protection against unauthorized access to the simulation system and theft, corruption or destruction of software or data. Both IMASE and ISGT will have the ability to overwrite, clear, purge, and transfer classified data in accordance with NSA standards with NSA approved equipment. Each software component of the IMASE and ISGT will have a redundant backup capability and automatic save feature, allowing for the recovery of unsaved changes in the event of system failure.

**(7)** The IMASE computer architecture and design must incorporate state-of-the-art technology, conform to the open systems design concept, and support logistics and configuration management. It must be interoperable with approved COE, HLA, and DIS/PDU protocols and standards.

**(8)** IMASE must provide design flexibility to accommodate anticipated future weapons systems, tactics, doctrine, and threat during its anticipated life cycle. As an Army-wide test system, IMASE design must anticipate Pre-Planned Product Improvements (P3I) in response to approved force modernization initiatives.

**(9)** Software documentation will be sufficient to support system operation/maintenance activity at all Government-designated locations, to include applicable licenses for all vendor supplied software.

**(10)** Technical Data. Technical data sufficient to support operation/maintenance activities and configuration control of IMASE hardware and software will be required.

**(11)** Onsite software maintenance facilities will be available in the central or remote analysis facilities for life cycle support of fixed installation sites; and designated sites for the deployable systems.

**e. Human Systems Integration.** Man-machine interfaces for IMASE and ISGT test support personnel must be compatible with commercial standards and practices.

**(1)** The manpower necessary to operate the IMASE system-of-systems must be within the current and projected approved personnel authorizations.

**(2)** Fielding of IMASE will not create any new operator Military Occupational Specialty (MOS). Additional skills and other personnel qualitative increases will not be generated; and will generally fall within the proposed Additional Skill Indicator (ASI) for simulation system experience and like skills available through both government and contractor personnel. The primary IMASE operators will be organizational assets. Department of the Army Civilian (DAC) or contractor support personnel will normally perform operator tasks, supplanted by organizational assets (Test Officers and Test Non Commissioned Officers) on a case-by-case basis. Contractor support operator services will be required. Life Cycle Software Support personnel is required for software upgrades related to performance and/or system interoperability performance issues.

**(3)** The design of IMASE system components will enhance operational efficiency and interaction. Leveraging organizational/C4I skills/procedures/equipment for test and exercise planning, control, data analysis and reporting will maximize learning transfer to tactical applications (for example, *to train as you fight*). The software should provide a common man-machine interactive display and control interface for all software functions in order to maximize the efficiency of the operators' use of all software modules. All presentation materials, such as high-resolution maps with graphics must be clear and legible. The HTI must meet all applicable industry and Government Human Factors Engineering (HFE) requirements.

(4) The XM-COMSIM system shall generate a manpower requirement of approximately two man-years (3,760 man-hours computed at 1,880 man-hours per man-year) for the suite of TRIM PII systems. This estimate is based on normalized annual usage factors, equipment maintenance, preparation for operation, transportation to and from test/training locations, and pretest/posttest adjustments.

**(5)** The XM-COMSIM shall be deployed, manned, and maintained by IEWTD Test Support Contractor personnel.

**f. Training.**

**(1)** Initial and follow-on training will be developed for IMASE primary operators to accomplish operator-level tasks. Maintenance training will be provided for performing operator-level troubleshooting and maintenance tasks and for Life Cycle Contractor Support (LCCS) contractor personnel performing all LCCS-level tasks. Test and exercise planning, control, data analysis and reporting procedures will leverage, to the maximum extent practical, existing organization personnel structures and expertise. Materials to accomplish initial/follow-on training will be developed to aid in performance of sustainment training by IMASE trained personnel under a Train-the-Trainer concept. Training will be hands-on and performance-oriented. The training program will include hands-on task instruction, culminating in a notional scenario training exercise for all tasks that includes a representative test report followed by a detailed, multimedia AAR for the training audience. Maintenance training will include instruction on how to operate test equipment and other support items required to perform routine maintenance and troubleshooting actions. Equipment operation should be included, if required, for troubleshooting, fault verification, Lowest Replaceable Unit (LRU) exchange or repair checkout.

**(2)** Training Materials. The materiel developer shall develop a training package for use by IEWTD Test Support Contract contractor personnel. Training materials for test data collection, reduction, and analysis shall be developed by IEWTD

**(3)** New Equipment Training. The materiel developer shall develop operational and maintenance New Equipment Training (NET). This training will provide the initial transfer of knowledge required by IEWTD to support initial testing and fielding of the simulator.

**(4)** Sustainment Training. Training required to sustain operator and maintainer proficiency and replacement training for new operator and maintenance personnel shall be provided by the IEWTD Test Support Contract contractor.

**g. Other Logistics and Facilities Considerations.**

**(1)** IMASE indigenous operators and support contractors will be able to set up, install and interface components, support system instrumentation installation, conduct readiness verification, perform system initialization, and operate the IMASE system-of-systems in either fixed facilities within cantonment areas or remote, unimproved locations.

**(2)** IMASE systems equipment will require minimum-environmentally-controlled facilities. The facility environment for fixed-site configurations (to include leveraging of tactical C4I components) and deployed and distributed sites will be exposed to the natural environment. It will encounter similar temperature extremes and weather effects as organizational C4I facilities and equipment

**(3)** Maintenance facility requirements will be identified through analysis of final system design. The analysis will determine, based on maintenance concept employed for the system, whether onsite maintenance facilities will be required to support fixed site configurations of the system and minimum essential requirements for deployable and distribute components/systems, to include storage requirements for spares, tools, and supplies. If identified facility requirements are not available onsite, analysis will also determine most cost effective means to acquire needed facilities or support.

**(4)** Spare/repair parts will be provided to the system site if determined necessary through analysis of final system design. Procurement of initial pool of spare/repair parts (as GFE) to support onsite repairs will be based on development contractor recommendations for an agreed to period of time (normally a one year supply) with the contractor providing replenishment to those levels to maintain required system availability.

**(5)** Logistics documentation will support system operation/maintenance activities and maintain system configuration control for its life cycle.

**h. Transportation and Basing.**

**(1)** Although IMASE will be used predominantly from fixed facilities, IMASE and its associated components must be easily transported to test and exercise sites either locally or deployed by means of either military or commercial means.

**(2)** Instrumentation associated with IMASE must also meet transportability requirements.

**(3)** IMASE will have capabilities to operate as a fixed site or semi-fixed site operational test, training, and instrumentation systems in support of designated installation sites and as fully deployable systems in support of distributed operations. IMASE will use available commercial power, and portable (yet stable) tactical power generation or commercial equivalents, when required. Individual IMASE components must be transportable by air, ground, rail, and water to facilitate spares replenishment and return of failed system components to the authorized depot or intermediate repair facility for routine or fault isolation/repair actions. Modular deployable components will be designed, to the maximum extent practical, to be transported in standard tactical (or commercial equivalent) transportation containers.

**(4)** The XM-COMSIM system will incorporate standard tie-down connections and be transportable by trailer to where it will be used.

**i. Geospatial Information and Services.**

**(1)** IMASE and ISGT will use National Imagery and Mapping Agency (NIMA) geo-spatial information products, where available, to create the synthetic battlefield.

**(2)** Digital mapping information must provide the density and detail equal to the paper based maps used by the test units and/or compatible with digital maps organic to unit tactical ABCS systems. Details include, but are not limited to: Universal Transverse Macerator (UTM) grid lines, contour lines, man-made features, vegetation, water, elevation, roads, and trails. The required digital map scales are 1:500,000, 1:250,000, 1:100,000, 1:50,000, 1:25,000, and 1:5,000.

**(3)** IEWTD will be responsible for providing topographic and geodesy support at each testing site for the XM-COMSIM.

**j. Natural Environmental Support.** All the equipment that comprises the IMASE and ISGT system is to be powered from commercial sources and be operated in facilities (fixed or tactical shelter) that conform to standard commercial power and environmental requirements. IMASE will use portable (yet stable) tactical power generation or commercial equivalents, when required.

**6. Force Structure.** Primarily employed by operational test commands, IMASE is also applicable in developmental testing, training and contractor testing located at select installation sites. IMASE will support force projection preparation and operations worldwide. Unit structures and materiel systems will be aligned against the approved design for the Initial and Full Operational Capability configurations and for any system that is traditionally or intermittently associated with the IMASE system. Specific missions and functions will be in accordance with support to operational test requirements and specific system under test design functions will executing operations within a realistic operational environment. IMASE will accommodate and support system design changes and changes due to approved force modernization initiatives. This will be accomplished for all IMASE primary components over their anticipated life cycle based on Initial and Full Operating capabilities and fielding schedules.

**a.** To minimize costs, the IMASE and ISGT development plan uses and builds upon the infrastructure of USAOTC, TTD, Information Management Division (IMD), Special Activities Branch (SAB) at Fort Hood, Texas.

**(1)** A minimum of two IMASE systems shall be required for operational test support.

**(2)** A minimum of six ISGT systems shall be required for operational test support.

**(3)** A minimum of eight XM-COMSIM systems shall be required for operational test support.

**b.** See Basis of Issue Guidance at Appendix E.

**7. Schedule.** (See figures 5 and 5a.)

**a. IMASE Initial Operational Capability (IOC).** Will provide the level of functionality currently available with TACSIM-OT. This version must be capable of supporting the ASAS Integrated Analysis and Control Element (ACE) test in May 2003 and Prophet Ground in FY04. IMASE would also provide support to the TOC environment for both the Prophet and CGS tests in FY03. Specific details include:

**(1) <u>Scenario Generation (support to ISGT)</u>.**

- IMASE Master Table of Organization and Equipment (MTO&E) database design in support of the ISGT application.

- IMASE and ISGT Scenario Simulation database design in support of ISGT application.

**(2) <u>Product Development</u>.**

- Simulation Control Component (for example, Simulation Initialization, Simulation States (Saves and Restores), and Simulation Modes (Dynamic versus Non-Dynamic).

- Simulation Event Logger Component.

- Simulation Timing and Process (Movement) Manager Components

- Simulation Interactivity Component (Interactive Unit Movement and Fire Mission Results).

- Intelligence Sensor Model(s) Design and Development.

- Electronic Intelligence (ELINT): AQF, GRCS-IPR, TEREC, RIVET JOINT, SENIOR RUBY, EPDS, PROPHET.

- Communications Intelligence (COMINT): AQF, GRCS-IPR, COMFY LEVI, RIVET JOINT, SENIOR SPEAR, TRAILBLAZER, PROPHET, ENHANCED TRACK WOLF.

- Imagery Intelligence (IMINT): UPD4, RF4C, SHORT-RANGE UAV, Ground Station Module (GSM), IPDS.

- Human Intelligence (HUMINT): Blue Front Line Troop Report (BFLTR).

- Intel Production Component (Message Format Standards: USMTF 2000, USSID 1990, IEW Character-Oriented Message Catalog (IEWCOMCAT) 1990; analyzed and raw intelligence products).

- Message Consolidation Component (for example, ELINT Consolidation Utility (ECU)/IMINT Consolidation Utility (ICU) capabilities combined with SUT MRM).

- Intelligence Asset Tasking and Tracking Component.

- Intelligence Messages database design.

- Intelligence Message Editor Capability.

- Scripted Radio Transmissions database.
- Interoperability with other simulations via HLA/DIS-PDU.
- Weather and Terrain Effects on Unit Mobility and Sensor Modeling.
- Implement multi-security levels (Collateral through SCI).

**(3) <u>Product Delivery</u>.**

- IMASE Limited Product Delivery Manager Component (Interface Existing).
- TACSIM Router In/Out Processor (TRIOP) TACSIM-OT communication system with IMASE.

**(4) <u>Performance Scoring</u>.**

- TIQS Remodernization Effort (Personal Computer (PC)-based, Windows-like desktop environment with Access DBMS).
- Current Scoring capabilities for Situation Development (PIRs, IRs), Target Development (HVTs, HPTs), and Situation Awareness (Relative Common Picture (RCP)).

**b. <u>ISGT IOC</u>.** Support to the Prophet and JTT test event in FY03 and Prophet in FY04.

**(1)** Support to Scenario Generation, Phase I.

- External Database Support.
- User Interface.
- Operational Graphics.
- Force Structure and Maneuver.
- Detailed TO&E.
- Archiving Scenario Data.
- Communications Net Structure.

**(2)** Voice Transmission Tool, Phase I.

**(3)** Blue Player Products, Phase I.

**(4)** Visualization Tool.

**c. <u>XM-COMSIM IOC</u>.** Support to the Prophet test event in FY04.

**(1)** Communications Simulation, Phase I.

**(2)** Communications Modeling.

**d. <u>IMASE Full Operational Capability (FOC)</u>.** Full functionality expected 2Q FY05. This capability will enable IMASE to provide robust support in the areas of scenario generation, product development, delivery, and SUT performance scoring. The IMASE capabilities at FOC will provide support to CGS (FY04/05), Prophet (FY05), ASAS (FY05/07), ACS (FY05-FY07), and beyond. IMASE will provide the primary M&S support structure within an M&S federation.

**(1) <u>Scenario Generation</u>.**

- Friendly communications, radar, and operations capability.

**(2) <u>Product Generation</u>.**

- Intelligence Sensor Model(s) Design and Development.
- Improved Remotely Monitored Battlefield Sensor System (I-REMBASS AN/PSQ-7).
- Tactical Exploitation System (TES) and Divisional Tactical Exploitation System (DTES).
- Airborne Reconnaissance Low (ARL)/ ACS.
- Counterintelligence (CI) HUMINT.
- CI HUMINT Automation Tool Set (CHATS) AN/PYQ-3(V) (CHIMS).
- Advanced Electronic Processing And Dissemination System (AEPDS).
- Modernized Imagery Exploitation System (MIES).
- Mobile Integrated Tactical Terminal (MITT).
- Enhanced Tactical Radar Correlator (ETRAC).
- EPW Operations.
- Airlift and Sealift Operations.
- POSIX compliant operating system capability.

- Interoperability with other simulations (STORM, WARSIM).

**(3) Product Delivery.**

- Fully capable IMASE Delivery Manager Component.

**(4) Performance Scoring.**

- Upgrade IPAGE with testing visualization tool

**e. ISGT FOC.** Support to DTSP, CGS, ACS, JTT, and Prophet test events in FY05.

**(1)** Scenario Generation, completed.

**(2)** Voice Transmission Tool, completed.

**(3)** Blue player products, completed.

**(4)** Visualization Tool, completed.

**(5)** Database Search and Mining Tool, completed.

**f. XM-COMSIM FOC.** Support to ACS, Prophet test events in FY05.

**(1)** Communications and Noncommunications Injection Capability, completed.

**(2)** XM-COMSIM Models, completed.

(3) Simulation Interface, completed.

**8. Program Affordability.** See the following charts for program affordability.

| 30-Nov-01 | FY02 | | | FY03 | | | FY04 | | | FY05 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L:M&S/Bud/OTCMiniPOMInput | R&D | O&M | ATEC M&S | R&D | O&M | ATEC M&S | R&D | O&M | ATEC M&S | R&D | O&M | ATEC M&S |
| **IMASE (ISSS)** | 1093000 | 0 | 0 | 1080000 | 334000 | 0 | 1043000 | 348000 | | 1069869 | 363900 | |
| **Previous POM Input** | N/A | | | 1050000 | | | 1520000 | | | 1200000 | | |
| ***OTIP** | 50000 | | | 550000 | | | 560000 | | | 570000 | | |
| **Misc.** | | | | | | | | | | | | |
| **ISGT** | | | | | | | | 375,333 | | | 394,100 | |
| **Previous POM Input** | 5091000 | | | 3775000 | | | 3645000 | 1126000 | | 2514000 | 1182000 | |
| **Unfunded** | 0 | | | 1281000 | | | 0 | 1126000 | | 2514000 | 1182000 | |
| | | | | | | | | | | | | |
| **Misc.** | | | | | | | | | | | | |
| **VTT** | | | | | | | | 375,333 | | | 394,100 | |
| **Previous POM Input** | 1318000 | | | 1062000 | | | 0 | | | 0 | | |
| **Unfunded** | 1318000 | | | 1062000 | | | | | | | | |
| | | | | | | | | | | | | |
| **Misc.** | | | | | | | | | | | | |
| **COMSIM** | | | | | | | | 375,333 | | | 394,100 | |
| **Previous POM Input** | 1265000 | | | 3579000 | | | 4221000 | | | 4623000 | | |
| **Unfunded** | 1056000 | | | 3579000 | | | 3700000 | | | 4623000 | | |
| | | | | | | | | | | | | |
| **Misc.** | | | | | | | | | | | | |

**NOTES: * OTIP was effort to partially offset no POM funding. $50K received in FY02. FY03 and beyond is unknown at this time.**

****O&M versus ATEC M&S. All items listed under O&M until more information becomes available on the definition of ATEC M&S.**

| FY06 | | | FY07 | | | FY08 | | | FY09 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| R&D | O&M | ATEC M&S | R&D | O&M | ATEC M&S | R&D | O&M | ATEC M&S | R&D | O&M | ATEC M&S |
| | | | | | | | | | | | |
| 0 | 1055986 | | 63172 | 709285 | | 65699.76 | 1151821 | | 68984 | 1204.127 | |
| 1300000 | | | 1300000 | | | | | | | | |
| | | | | | | | | | | | |
| | 413,805 | | | 503,644.00 | | | 456218 | | | 479029 | |
| 2284000 | 1241000 | | 1246000 | 1511000 | | | 1368000 | | | 1437000 | |
| 0 | 1241000 | | 0 | 1511000 | | | 1368000 | | | 1437000 | |
| | | | | | | | | | | | |
| | 413,805 | | | 503,644.00 | | | 456218 | | | 479029 | |
| 0 | | | 0 | | | 0 | | | | | |
| | | | | | | | | | | | |
| | 413,805 | | | 503,644.00 | | | 456218 | | | 479029 | |
| 5270000 | | | 5523000 | | | | | | | | |
| 2245000 | | | 1425000 | | | | | | | | |
| | | | | | | | | | | | |